Falta de qualidade da educação brasileira: Qual a magnitude do problema?

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NATIONAL EDUCATIONAL POLICIES AND THEIR CONSEQUENCES FOR QUALITY AND EQUITY

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In this paper we investigate how several national educational policies and practices influence both students' average reading achievement and the social distribution of achievement within schools and countries. Data come from the 2000/2001 administration of PISA (Programme for International Student Assessment) by the Organization for Economic Cooperation and Development (OECD). They include observations from 212,880 15-year-old students attending 8,038 secondary schools, which are located in 39 countries. We analyze these data with three-level Hierarchical Linear Models (HLM), with students nested in schools, which are nested within countries. Results focus on the role played by three country-level educational policies: (1) retention/repetition; (2) the mix of students in schools based on socioeconomic status (school social mix); and vocational education. We explore how these policies influence the social distribution of achievement between schools within countries. Implications of these findings are discussed.
Introduction

Enduring questions of educational policy receive systematic attention from sociological researchers across national boundaries from time to time. The composition of schools based on their students' socioeconomic background -- what might be called "social mix" -- is one of these enduring issues. This issue has been discussed at least since the publication of classic work of Wilson (1959), who explored how the socioeconomic composition of high schools influenced the college aspirations of low-SES students. A major focus of the Coleman report (Coleman et al. 1966) was racial desegregation and social mix in the form of school racial composition.

Although several sociological studies have emphasized the importance of promoting social mix within schools (Boyle 1966; Rutter et al. 1979), there is an enormous challenge in implementing social integration policies that promote both quality and equity in education. In several cases, social mix in the U.S. pursued on the basis of bussing policies proved problematic, as deprived neighborhoods become even more deprived. In these cases, policies advocating school social mix are challenged because they often come in direct conflict with school racial composition that results from extreme residential segregation. Middle-class families who are opposed to increasing social mix in their children's schools often "vote with their feet" by fleeing to wealthier neighborhoods. This results in formerly socially mixed communities and their schools becoming poorer and less integrated. This trend applies as much to U.S. areas as to the poor suburban bedroom communities in Latin America.

Another recurring issue on the international educational agenda relates to policies that focus on low-achieving students. Despite the existence of a substantial body of research documenting problems related to grade repetition or retention (e.g., Jackson 1975; Shepard and Smith 1990; Gomes-Neto and Hanushek 1994), policies that decry retention and advocate social promotion are not trouble-free. Some policy reversals about retention and social promotion are now occurring (Gomes-Neto and Hanushek 1994; Roderick, Bryk, Jacob, Easton, and Allensworth 1999; Nagoaka and Roderick 2004).

A third issue that has occurred periodically on the educational research agenda for several decades centers on the advantages and disadvantages of vocational education in secondary schools, compared to general academic education for all secondary students (Gamoran 1987; Natriello et al. 1989; Levesque et al. 2000). Although in most regions of the globe there is a definite preference for academic education for all students, in several
European countries vocational secondary education continues to be widespread, and it is even being re-enforced (Shavit and Muller 1998).

These three recurring educational issues — school social mix, retention, and vocational education — pose challenges not only to schools and local educational authorities but also to education policies across national borders. Due to differences in national cultures about the purpose of education and young people's transitions from school to work, policies related to vocational education in secondary schools vary widely across national boundaries. In regard to repetition and social mix, there is considerable international consensus among researchers that schools and countries should limit the policy of requiring low-achieving students to repeat grades and should organize education toward more social mix in schools. Despite such consensus among researchers and policymakers at higher levels, there is an enormous challenge at the local level to implement both promotion-based educational policies — as an alternative to repetition-based policies — and to increase the social mix in the composition of schools in the face of extreme residential economic segregation. Such challenges are particularly daunting when considered within the context of an increasingly economically inequitable world. Consequently, there is wide variation in the extent to which individual countries are succeeding in confronting these important issues.

Variation in how countries enact and implement policies about school social mix, grade repetition, and vocational education is likely to influence both the quality and the equity of education outcomes in them. In this study we make use of recent and high-quality cross-national educational data to address these issues. We explore the extent to which country-level policies related to retention, school social mix, and high-school vocational education influence how adolescents fare academically. We investigate the effects of these policies on two outcomes: (1) students' average reading achievement [quality] and (2) the social distribution of achievement across schools [equality] in several countries. In the next section we discuss national policies about grade repetition, school social mix, and vocational education, to provide a background for our own exploration of the effects of national policies on the quality and equity of education.

Theoretical Background

Centralized and Non-Centralized Education Systems

There is wide variation in the extent to which education is regulated by national laws and standards. Though some countries have laws concerning
such educational issues as curriculum content, funding of education, teachers' qualification and salaries, and criteria for students' grade promotion, in other countries decisions about these policies are made by state or local authorities. Even if school systems are centralized, educational policies and practices conform to the values, beliefs, and constraints that shape each society. As a consequence, national features of educational systems are evident both in countries where education is centralized and in those where education policy is more subject to local control. An example involves policies about grade retention (often called repetition). In Latin American and African countries, retention is used as a filter for selection, so that only a fraction of each age cohort actually enters or graduates from secondary education. Retention rates are moderate in developed countries such as the U.S. In other developed countries, such as Great Britain and Japan, grades are almost entirely organized by age, and retention is quite rare.

We investigate the extent to which we are able to explain between-country differences in both average achievement (we call this quality) and in the social distribution of achievement (equity) as functions of several national policies related to education. Although there is extant research on the effects the three policies we focus on—school social mix, retention, and vocational education—within countries or within smaller contexts, we locate no cross-national research that focuses on the consequences of such policies. Our brief review of literature on these policies is meant to set the stage for our consideration of the impact of these policies on educational outcomes in the cross-national context.

School Social Mix

The variation in a school's enrollment related to the socioeconomic status (SES) of its students is what we call school social mix or "SES mix." Research about the effect of school social mix on student achievement builds on earlier research about the effect of social mix on aspirations for education beyond high school (Wilson 1959; Boyle 1966) and by findings about how racially integrated schools influence minority students' achievement (Coleman et al. 1966). Coleman and colleagues argued that the effect of racial integration is asymmetric, in that effects on minorities were much stronger than on non-minority students. However, this issue was not a major factor of the Coleman report.

Subsequent research on the effects of school social mix on achievement that dealt with this theme in more detail reported inconsistent results. Some studies' results were consistent with the asymmetric hypothesis, in that they
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reported stronger positive effects on lower-SES students of attending schools with socially heterogeneous populations (i.e., with high social mix), with few effects - either positive or negative - on middle-class students (Summers and Wolf 1977; Henderson, Mieszkowski, and Sauvageau 1978; Lauder and Hughes 1990). On the other hand, Willms (1986) found that the positive effect of school social integration on lower-SES students was counterbalanced by negative effect on higher-SES students. Along the same line, in their review of the literature Lee, Bryk, and Smith (1993) pointed out that the effect of school social mix on school average achievement and on teachers' self-efficacy was relatively modest.1

In sum, whereas the available literature is unambiguous in emphasizing that lower-SES students benefit from attending schools with high social mix, the literature is inconsistent about whether school social mix has a generally positive effect -- as emphasized by the asymmetric argument -- or whether school social mix is a zero-sum policy. As designed, our research may not resolve this controversy about how school policies and practices are linked to learning. However, we contribute to the discussion outlined above by exploring to the extent to which school social mix may explain between-country differences in average achievement and its social distribution.

Retention or Repetition

Policies related to repeating grades vary widely around the world. An overview of the national statistics related to retention reveals three basic national patterns: (1) countries in which grade repetition is nonexistent or negligible; (2) countries in which the rate of repetition is medium and a matter of serious concern for educational policy; and (3) countries in which retention rates are so high that, in practice, retention works to determine who will and will not have the opportunity to complete secondary education and potentially attend a university.

Although retention rates and concerns about retention at the national policy level differs considerably among nations, the findings from research about how retention influences students who experience it is consistent. The findings fall into three categories. First, retention is unequally distributed within the student population, with the least advantaged students more likely to be retained (Jackson 1975; Alexander, Entwistle, and Dauber 1994). Second, retention increases the probability of a student dropping out of school (Grissom and Shepard 1989; Roderick 1994; Allenworth 2004). Third, retention fails to solve most learning problems of retained students (Alexander et al. 1994; Roderick et al. 1999; Roderick and Nagaoka 2004; Shepard and Smith 1990).
Despite near unanimity about the negative consequences of retention, its alternative -- social promotion -- has been criticized for stimulating an non-rigorous path through the educational system for students (Gomes-Neto and Hanushek 1994). Reducing social promotion has been shown to improve the achievement of promoted students (Roderick et al. 1999). For retained students, there are a few findings indicating some learning benefits for students repeating a grade (Alexander et al. 1994; Gomes-Neto and Hanushek 1994). However, the vast majority of the research on this topic concludes that retention typically increases the achievement gap between retained and non-retained students, when compared with the alternative policy of not retaining students (Holmes and Mathews 1984; Roderick and Nagaoka 2004; Shepard and Smith 1990). No studies focus on alternative educational experiences for students who repeat a grade, perhaps because such experience are very unusual.

Given the generally negative effects of retention on achievement, it is surprising that the policy is still so common -- particularly in developing nations. Considering the consistency of research findings, and given that we make use of a dataset where the sample is based on age (15 years old -- see data description below), we hypothesize a substantial negative effect of policies that induce high retention rate on national averages of achievement.

Vocational Education

Among sociologists of education, there is consistent evidence that curriculum differentiation, in general, and vocational education as a particular form of curriculum differentiation, is associated with an inequitable distribution of achievement (Gamoran 1987; Jones et al. 1986; Lee and Bryk 1988; Natriello et al. 1989). Despite this evidence, Levesque and colleagues (2000) make a convincing argument that many of the research findings about the negative effect of vocational curriculum participation are a result of selectivity bias. That is, lower-achieving students are often encouraged into vocational education (or opt it themselves), and they are likely to choose to engage in less rigorous coursework than their higher-achieving peers, thereby compounding their academic disadvantage and widening the achievement gap. Access to longitudinal data would be important to evaluate the alternative hypothesis advanced by Levesque et al. (2000). However, Lee and her colleagues (1998) made use of longitudinal data from the National Education Longitudinal Study (NELS:88) to investigate the effect of high school curriculum structure on students' achievement. They concluded that that curriculum differentiation (including vocational education)
promoted inequality in course taking. These practices by students promoted lower levels of learning for students who enrolled in less demanding courses, including those associated with vocational education. Their results led them to advocate less curriculum differentiation, especially eliminating undemanding courses in secondary school.

What do these findings about curriculum differentiation imply for international research? A direct implication of research results about curriculum differentiation of within-country research (mostly in the U.S.) exploring the effects of vocational education on achievement suggests that we should expect that a national emphasis on vocational programs in secondary schools might lead to a less equitable social distribution of achievement. Another implication is that a national emphasis on vocational education might influence countries' average achievement.

Research Using PISA
There is a growing body of research using data from PISA. The large majority of studies focus on topics that are quite different from the one we pursue in this study. For instance, there are studies on comparative effectiveness of private and public schools (Vanderberghe and Robin 2004, Corten and Dronkers 2006), on gender differences (Van Langen, Bosker and Dekkers 2006), on family background and school factors (Marks, Cresswell and Ainley 2006, Thorpe 2006, Fertig and Wright 2005, Lee, Franco and Albernaz 2005, Nash 2003) on the effect of socioeconomic background on achievement (Willms 2006, Marks 2006, Gorard and Smith 2004, and Nash 2003). Virtually all these studies used multilevel methods. The vast majority of PISA studies conducted analysis separated by countries, as we have done in another study (reference to be entered later). We located only one study (Corten and Dronkers 2006) that combined PISA countries in a single analysis, as we have done in this study. We also located one study (Van Langen, Bosker and Dekkers 2006) that used additional country information - participation of women in college in the areas of science, technology, engineering and mathematics - in order to investigate whether moderation of gender gap between schools and across countries promotes greater enrollment of women in science-related tertiary education. Our study makes use of the multilevel approach that guided most PISA studies. It also shares two features presented by the two conducted the joint analysis for several countries and the use of additional country level data. In our study the aim is to investigate the effects of three national educational policies on student academic outcomes, as specified below.
Research Questions

Question 1: Policy and quality. Are national educational policies associated with school social mix, grade repetition, and vocational education linked with educational quality, defined by 15-year-old students' achievement in the domain of literacy? If so, are the effects of these policies positively or negatively associated with quality?

Question 2: Policy and equity. Are countries' educational policies concerned with school social mix, repetition, and vocational education also associated with educational equity, defined by the social distribution of achievement by students' SES both within and between schools? If so, are the effects of these policies to increase or decrease social equity in educational outcomes?

Method

Data

We draw data for this study from a current and ambitious cross-national educational collection effort sponsored by the Organizational for Educational Cooperation and Development (OECD), the Programme for International Student Assessment (PISA) (OECD 2002). The 2000/2001 PISA data collection was intended to be the first of many such efforts. PISA 2000/2001 is a cross-sectional study that included 43 countries; the majority (28) were members of OECD, but PISA also included several (15) non-member countries. This first ambitious international effort focused on students' achievement in reading, with smaller assessments in mathematics and science. Subsequent PISA studies focus more on these other disciplines. Besides achievement scores, PISA also included survey information about students, their families, and schools. Students and school principals were surveyed, but teachers were not.

The PISA sampling strategy centered on students of a particular age: 15 years. Approximately thirty 15-year-old students were sampled from a stratified national sample of secondary schools in each country, regardless of their grade. The data we use, which comprise close to the full PISA sample, include survey information and test scores from 212,880 15-year-old students, who attended 8,038 secondary schools which were located in 39 OECD and non-OECD countries. Although our data about students and schools come directly from PISA, we drew country-level data from UNESCO and World Bank sources.

We excluded four participant countries from our analysis: Macedonia, Bulgaria, Liechtenstein, and Albania. Our decision to exclude Macedonia,
Bulgaria, and Liechtenstein was because they lacked the country-level data we needed. We excluded Albania for statistical reasons: we first estimated our multilevel models including Albania and verified that the data from Albania violated some assumptions of model estimation; Albania was clearly an outlier. After we dropped Albania and re-estimated our models, statistical information revealed compliance to the assumptions of model estimation. The exclusion of Albania changed point estimations only slightly without any major change in hypothesis tests concerning variance. For the remaining 39 countries, our analysis of residuals indicated that our analytic models complied well with the assumptions of the model.

**Measures**

Our dependent variable is the reading achievement of 15-year-old students attending schools in the 39 PISA-participant countries. The PISA reading test measured "the ability to understand, use, and reflect on written texts in order to achieve one's goals, to develop one's knowledge and potential, and to participate effectively in society" (OECD, 2001:21). Using student performance on items on the reading test, the PISA team used Item Response Theory (IRT) to develop several estimations of IRT-based measures of reading achievement (OECD 2001). In this study we make use of what is called the "Warm-estimated" IRT score as our dependent variable. We chose this particular score because it is based on students' performance on the reading items, and has not been conditioned on students' background. Readers wishing more information about the psychometric properties of the several proficiency measures available in PISA are referred to the PISA technical manual (OECD 2001).

The independent variables considered in this study are measured at three levels: students, schools, and countries. Student-level measures include the PISA-constructed SES composite, based on students' reports of parents' education, parents' occupational status, and the availability in their households of resources related to wealth and to education. The only school-level variable we use is school average SES, which we created by aggregating the student SES to the school level. We included three country-level variables: country average of schools' social mix, emphasis on vocational education, and a set of two dummy variables based on the proportion of students that repeated grades in each country. We also included a country level control variable: the national average educational expenditure per student. We drew our information on repetition, vocational education and expenditure per student from World Bank and UNESCO databases. We provide some
basic information about measures we use to describe students, schools, and countries in Table 1.

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Insert Table 1 about here
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We left dependent variable, reading achievement, in its usual PISA metrics. This variable has a mean \( \text{M} \) 500 and standard deviation \( \text{SD} \) 100 among the 28 OECD countries. However, in our sample of 39 countries, the actual mean is slightly lower (486) and the SD slightly higher (105). We standardized our measures of student SES, school SES, and school social mix for our sample (\( \text{M}=0, \text{SD}=1 \)). Our country level measure of school social mix was obtained by averaging for each country the SD of SES in each school. The full description of the other variables used in the analysis is presented in Table 1.

In Table 2 we provide some descriptive information about the 39 countries included in the analysis. For making reading of this table easier, we present in this table information on continuous measured variables into thirds, and list the countries included in our analysis in order of their average achievement. Readers can note that the countries from which the authors of this paper come are not near the top. U.S. 15-year-olds scored near the middle in PISA, and Brazilian 15-year-olds near the bottom. The latter is particularly noteworthy, in that a large percentage of Brazilian students have left school by age 15, so the Brazilian sample is somewhat select. Order of countries' scores is not directly related to its level of economic development.

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Insert Table 2 about here
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Although the PISA countries with high repetition rates (between 40 and 50 percent) are all at the bottom of the achievement distribution (Brazil, Indonesia, Peru), the distinction between low (below 10 percent) and medium (10-20 percent) repetition rates seem unrelated to the achievement ranking. Expenditure per student is closely associated with achievement rankings, with a few exceptions. Countries' emphasis on vocational education is not at all associated with achievement rankings, at least not in the order one would expect based on research about the effects of vocational education on achievement.

Analytical Approach

Our investigation involves students nested in schools, which are
in turn nested within countries. Thus, our analytical approach uses Hierarchical Linear Model (HLM -- Raudenbush and Bryk 2002). Our interest in the quality of education across countries led us to model school average achievement, which we controlled by school average SES. Our interest in equity led us to model both the school-level SES/achievement slope (within-school equity) and the country-level average SES/achievement slope (between-school within-country equity).

As suggested by Raudenbush and Bryk (2002), we adopted a bottom-to-top modeling strategy. We started by fitting a fully unconditional model, in order to partition the variance of the outcome into its three components: (1) within schools, (2) between schools within countries, and (3) between countries. Next, we fitted a random coefficient model, including only students’ SES at Level 1. As both the Level-1 intercept and the students’ SES slope varied between schools within countries, it was reasonable to control the intercept for school average SES. Moreover, the specification of a model with a control for school average SES was important, as it allowed us to investigate the extent to which school SES/achievement slopes would be influenced by the country-wide policies considered in this study.

This model specification process also guided the formulation of our final model in our bottom-to-top modeling strategy. Here, the three Level-2 coefficients (school average achievement, student level SES/achievement slope, and the school average SES/achievement slope) are all random variables at level 3 (between countries). These are the random variables, which are modeled as a function of variables that express national educational policies, namely, repetition, school social mix, and vocational education. As students’ achievement is strongly influenced by the expenditures that each country can afford to spend in education, we controlled our analysis by the average expenditure per student in secondary education. We tested all country-level variables on the three Level-3 outcomes. However, although we retained all variables in intercept model, we retained only the cross-level interaction terms that were statistically significant in the models of the two random slopes.

**Results**

**Level 1: HLM model.** Results for our fully unconditional HLM model indicate that 50.7 percent of the total variance in achievement lies at Level 1 (between students within schools), 27.7 percent is at Level 2 (between schools within countries), and 21.6 percent is at Level 3 (between countries). We next estimated a level-1 random coefficient model by adding
student SES. Table 3 presents these results, which indicate that across schools, average achievement controlled for student SES is 476.8. Average achievement varies between schools within countries and between countries (both at p<.001). Table 3 also indicates the average within-school effect of students SES on achievement (17.5 points for a 1 SD change in SES). This effect also varies between schools within countries and between countries (both p<.001). In the level-2 HLM model we included a control for school average SES. These results are presented in Table 4.

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Table 3 and 4 about here
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**Level 2 HLM model.** In Table 4 the Level-1 intercept is modeled as function of school average SES. The results presented in Table 4 are well in line to the ones already commented in the context of presentation of level 1 model. In addition to these results, Table 4 indicates that an increase of one SD in school average SES is associated to an average increase of 99.9 in school average reading achievement. The strength of the association vary between countries (P<0.001).

**Final 3-level HLM model.** The results of our final HLM model, shown in Table 5, represent the major focus of this study and address our two research questions. The three coefficients that vary randomly between countries -- school average achievement, the within-school SES/achievement slope, and the school average SES/achievement slope -- are our level-3 outcomes. It is here that we consider the effects of country-level educational policies on quality (higher achievement) and equity (lower effect of student SES and school average SES on achievement). As Level-1 and Level-2 coefficients remained stable across the sequence of models just described, in Table 5 we simplify results by presenting only the results from our final Level-3 HLM model.

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Table 5 about here
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**Results focused on quality.** Based on the research about grade repetition, the results in Table 5 are perhaps not surprising. Compared to countries with lower rates of repetition, there are very large and negative effects for countries with high (over 40 percent) and medium (10-20 percent) repetition rates (achievement differences represented by gamma coefficients of -81.5 and -26.3 points, respectively, both p<.001). In countries in which schools tend to serve a socially diverse students body average reading achievement is higher than in those where school social composition is more socially.
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homogeneous (an increase of 17.1 points for every 1 SD of school social mix, p<.001). In countries that emphasize vocational education, meaning that their secondary schools were differentiated rather than that all schools emphasized a general comprehensive curriculum focused on academic concerns, the coefficient for vocational education on average achievement is not statistically significant (although the point estimate is negative, -3.8 points). These results were obtained in models where we controlled for countries' average expenditure per student (a 16.3 point increase for every point in this logarithmic scale). Supporting results reported in the literature, we found negative effects for high and medium rate of repetition (compared to low rates). Our results for school social mix and for vocational education policy were not consistent with most findings on these policies. However, we should emphasize that our findings were obtained in the context of cross-national research, while the effect of social mix and of vocational policies are frequently investigated in the context of specific countries or regions.

Results focused on equity. We approached the issue of equity in the social distribution of achievement by considering both the main effects of our key variables and their cross-level interactions. In the first place, we turn to the student SES/achievement slope. We had already mentioned the positive effect of school social mix on school average achievement (gamma coefficient of 17.1 points). However, the gamma coefficient estimating the effect of school social mix on the student SES/achievement slope is positive (2.5 points, p<.05), slightly increasing the effect of students' SES on achievement. In short, higher school social mix increases quality (higher school average achievement) but also increases within-school inequality (higher effect of students' SES on achievement). In order to make the interpretation of these results more meaningful, we must consider the effect of school social mix simultaneously on average achievement and on student SES/achievement slopes. This can be visualized in Figure 1 which illustrates three important features of the model presented in Table 5:

- School social mix is linked with higher quality (i.e., higher average achievement is associated with more social heterogeneity in schools);
- School social mix is negatively linked to within-school equity (the higher the school social mix, the greater the achievement gap between lower SES students and higher SES students in the same school); and
- The positive overall effect of school social mix, expressed by higher levels of achievement for countries with more social heterogeneity in their
On the one hand, the pro-quality effect of school social mix is evident. On the other hand, we need to consider the interpretation of both the regressive effect of school social mix for within-school equity and the overall positive effect of school social heterogeneity. Low social mix means considerable social stratification of schools by SES. In an extremely low social mix school, however, the concept of within-school equity is meaningless. At the opposite extreme, high school social mix means that schools are challenged to deal with a diverse social composition, which is usually accompanied by considerable academic diversity.

In order to understand the effect of school social mix in this complex situation, we illustrate in Figure 1 the joint effect of school social mix on both average achievement and student SES/achievement slope. The graph emphasizes the positive overall effect of school social mix. We created Figure 1 by choosing arbitrary values for low/high school social mix and low/medium/high SES, but the trends would be independent of the values chosen for Figure 1. Our argument relies on a two-part computation of the overall effect of school social mix: its main effect on school average achievement and its interaction effect on the student SES/achievement slope. When the pro-quality effect is greater than the regressive effect related to an increase in the SES/achievement slope, we argue that the overall effect would be positive for most students. Here, the pro-quality effect on the school average (17.1 points) is much greater than the regressive effect related to the increase of the student SES/achievement slope (2.5 points). Thus we conclude that, on average, a country with policy leading to high social mix induces benefits for students.

We turn now to interpreting the effect of our key country-level policy variables on the school average SES/achievement slope. We estimated a positive effect for emphasis on vocational education (gamma = 25.2, p<.001). This means that in countries that emphasize vocational education, the relationship between school average SES and achievement is stronger than in countries where most students are enrolled in secondary schools that emphasize academics. As the effect of emphasis on vocational education on average achievement is non-significant (see top panel of Table 5), the only
way vocational emphasis influences achievement is to be linked with to
greater between-school inequality in the social distribution of achievement.
Figure 2 illustrates this feature.  

Insert Figure 2 about here

Keeping in mind the non-significance of our vocational education policy
on average achievement, Figure 2 illustrates the socially stratifying effect
of vocational education on students' achievement in reading. Holding all
other variables constant, the achievement gap between low-SES schools and
medium-SES schools is greater in countries that emphasize vocational
education (i.e., counties in which some high schools offer only vocational
education). The effect of emphasis on vocational education is limited to its
increase in inequality in the distribution of reading achievement. Although
in countries that emphasizes vocational education the mean achievement is
unaffected, achievement at these countries is more stratified by students' 
SES.

Expenditures on education. Table 5 also shows how country-average
average educational expenditures are linked with achievement. Although we
believe it is important to control for expenditures, we do not consider this
as an important policy variable; thus we do not emphasize these results. It
seems reasonable that the most important factor determining the amount of
resources that countries invest in secondary education is countries' wealth,
despite the fact that countries' investments in education may vary with the
proportion of their Gross Domestic Product (GDP) invested in education. It is
not reasonable to assume that this effort can actually be as elastic as is
the variance of our variable that captures the log of the U.S. dollars per
student invested by each country in secondary education.

Our findings here indicate: (a) that expenditure is important for average
achievement (gamma coefficient of 16.3, p<.001); (b) that higher expenditures
are associated with inequality (i.e., a higher school average SES/achievement
slope), suggesting that schools enrolling high-SES students are more likely
to receive even more resources than schools with low-SES students when more
resources are available; and (c) that expenditures are also associated with
higher student SES/achievement slope, suggesting that unless resources come
to schools based on specific polices that target within-school equity, more
resources increase within-school as well as between-school inequalities.

Because expenditure is associated to an increase of both quality and the
two types of inequality we consider here, it is wise to ponder the overall
effect of resources on achievement, in the same way we discussed the overall
effect of school social mix. In order to compute overall effects, we would
need to add the effect of educational expenditure on average achievement to
its effect on both school average SES/achievement slope and student
SES/achievement slope. This computation indicates that 96.3 percent of
students would benefit from increasing average expending per student.8 That
is, the effects on quality trump those on inequality. On the other hand, the
fact that increased expenditures may lead to inequality in the social
distribution of achievement within countries is something that educational
authorities need both to recognize and to learn how to deal with.

Explaining variance. Although explaining variance is far from the major
goal of this analysis, it is useful to see how country-level policies
concerning repetition, school social mix, and vocational emphasis, and
educational expenditures explain the between-country variance in achievement
(adjusted for student and school social differences). Compared to our
reference model in Table 4, the between-country Level-3 HLM model presented
in Table 5 explained 83 percent of the variance between countries in average
reading achievement, 30 percent of the variance in the school average
SES/achievement slope, and 44 percent of the variance of student
SES/achievement slope. Considering the modest number of policy-related issues
we considered in these models, we suggest that their success in explaining
differences between countries is impressive.

Conclusions

The average reading achievement of 15-year-old students participating
in PISA 2000 varied widely between the 39 countries we considered. For almost
all of the OECD member countries participating in PISA, the range of country
average achievement was within .5 SD of OECD mean. This represents a
considerable variation, considering that country average is itself an
aggregate measure of student and school measures. However, variation was even
greater for countries that were not OECD members. For most non-OECD countries
and also Mexico (which is an OECD member), country average achievement was a
full SD (100 points) below the OECD mean of 500. We also found that social
background -- considered for both individual students and schools -- was very
strongly associated with reading achievement within and between schools.

In this study, we explored some country-wide educational policies to
explain these differences. In combination, these policies -- on school social
mix, grade retention, and vocational education -- controlling for a measure of
countries' per-student expenditures on education, together explained a substantial proportion (over 80 percent) of the systematic variation in reading achievement between countries. We considered country average achievement as a measure of educational quality, as this achievement has been adjusted for student background. Because quality sometimes comes at the cost of educational equity, we also considered direct measures of educational equity, focusing on both the relationship between students' SES and achievement within schools and the relationship between school average SES and school average achievement within countries. In this regard, policies that are simultaneously related to quality (i.e., to higher average achievement) and to equality (i.e., to lower relationships between SES and achievement either within or between schools) we regard as "good policies."

Our findings suggest that national policies on school social mix and on grade retention are associated with educational quality across countries. Countries whose schools enroll a more heterogeneous population of students (i.e., with more school social mix) achieve higher quality (i.e., where average achievement is higher). However, in countries whose schools exhibit more social mix achievement is distributed less equitably. As argued earlier, when these results are considered simultaneously, findings about quality related to school social mix are considerably stronger than those about inequality. Our findings lead us to conclude that increasing school social mix is a good policy. Because school enrollment is generally tied to residential location, and because residential location is often highly stratified economically, policy makers might not see increasing school social mix as a distinct social policy. We disagree. Which schools are attended by which students is an issue within the purview of policy. We urge that educational policymakers consider seriously reducing the social stratification of school enrollment.

Our findings about retention are perhaps not surprising, given that the large preponderance of research on retention or repetition demonstrates that this policy is ineffective or actually damaging. Our evidence on repetition provides additional cross-national support for previous findings. Compared to countries where repetition rate is low, countries with medium repetition rates, and especially those with high repetition rates, are consistently lower in terms of the quality of education.

We shall now turn to the issue of vocational education. A glance at Table 2 will remind readers that the vocational emphasis countries are mostly developed, including many high-achieving European countries (e.g., Finland, Belgium, U.K., Switzerland, Germany), some Asian countries (Hong Kong,
Australia), some Eastern European countries (Hungary, Czech Republic, Poland), and at least one Latin American country (Argentina). That is, vocational emphasis does not seem to be tied to economic development. Our findings about the policy of vocational education in secondary schools suggest that this is unrelated to quality but rather strongly related to equity -- especially to our equity measure at the school level (the average SES/achievement slope). Our analyses suggest that if countries emphasize vocational education between schools, a more inequitable distribution of achievement by SES results. Although this is not surprising, given that enrollment in vocational education has been shown to be tied to students' social background, we suggest that counties need to pay attention to equity as well as quality. And the evidence here is clear: vocational emphasis leads to social inequality in the distribution of achievement.

Although our focus has not been on how per-pupil expenditures on education influence quality and equality in educational outcomes, we feel obliged to report that although expenditure are surely positively related to quality (unsurprising), increasing expenditures seems to lead to inequality both within and between schools. This is likely to derive from two sources. Although within a particular country, there is a logic that would suggest that expenditures should be unequally distributed -- with schools that need the most resources receiving them -- the evidence is that the opposite happens. Between-school inequality in the distribution of achievement by social background is increased, as it would seem that more expenditures actually go to schools that probably need them the least.

We also have evidence that national expenditures increase inequality within schools. This suggests that, even within school, higher SES students may benefit more than lower SES students from the available resources of schools. In this context, promoting equality within schools involves awareness and commitment from teachers, in order to assist those students who most need school resources to make a profitable use of them. Our findings about expenditures lead us to at least one conclusion. Schools and countries should pay close attention to how resources are distributed and not just to the total resources devoted to education. We draw another broader conclusion from this piece of research: Educational policymakers should pay as much attention to equity as to quality. Truly good education and good educational policies must focus on both of these aspects of the distribution of educational outcomes.

The findings reported here suggest that most countries should pay greater attention to their retention policies, to the policies that affect the school
social mix, and to social stratification in education by means of vocational education. Our results about vocational emphasis reveal that although its effect on quality is neutral, its effect on the equitable distribution of achievement between schools within countries is regressive. This finding is particularly important within the context of the emphasis within the PISA data collection on assessing of learning skills for life. The PISA framework for assessment relies on the basis that reading competencies are essential not only in comprehensive academic education but also for meeting the increasing demands of a changing work environment. In this context, countries emphasizing vocational secondary education will have to cope with the challenge of justifying their highly stratified educational systems in light of the new and broader literacy demands of twenty-first century workplaces.
Technical Notes

1. It is important to understand that school social mix and school average SES are intertwined: a school with high SES mix, by definition, cannot have a very low or very high average SES. This leads to an important conclusion: Very low-SES or very high-SES schools are schools, by definition, with low SES mix. It is reasonable that schools with both low SES mix and low average SES are very different from schools with low SES mix and high average SES. In order to accommodate this situation, researchers would need to include interaction terms for SES mix and average SES, a practice that we did not observe in the literature on this topic.

2. See OECD (2001) for a full description of this item.

3. In fact, our dummy variables are based on the proportion of students with age-grade gap. As the main reason for the age-grade gap is repeating, we take these variables as proxy of repeating. However, we know that entering into school late is also a factor that has some impact in age-grade gap in some countries.

4. In our final 3-level HLM model displayed in Table 5 we did not include school social mix at level-2. However, we investigate an alternative model where at level-2 we included 2 dummy coded variables describing school with high and medium social mix, both compared to low social mix schools. Results suggested that school average achievement was lower in school where social mix was high (versus low), but medium level social mix was unrelated to average achievement. Because the level-3 results displayed in Table 5 were unchanged, we decided to present results from the more parsimonious model shown in Table 5.

5. For graphing, we assumed that low and high SES mix correspond to the 10th and 90th percentiles. Analogously, we assumed that low, medium, and high SES within schools corresponds to the 10th, 50th, and 90th percentiles.

6. Holding the value of all other variables included in the hierarchical model constant, the effect of social mix on achievement can be written by adding the main effect of social mix to the cross-level interaction term involving social mix:

\[ \gamma_{00} + \gamma_{102} \text{SES}_{ik} \]

This can be re-written as: social_mix (\(\gamma_{00} + \gamma_{102} \text{SES}_{ik}\)).

If social mix assumes a positive value, the effect on achievement will be positive whenever the expression in parenthesis is positive. Given that both \(\gamma_{00}\) and \(\gamma_{102}\) are positive, the effect will be positive for all students whose SES value is positive and for all students below average SES provided that \(\text{SES}_{ik} > - (\gamma_{00} / \gamma_{102})\). Applying the values fitted for the mentioned coefficients and considering the measures of SES available in the dataset, we verified that high school social mix is positive for every student.

7. For graphing, we assumed that low, medium, and high school average SES corresponds, respectively, to the 10th, 50th, and 90th percentile.
8. Holding the value of all other variables included in the HLM model constant, the effect of average expenditure per student on achievement can be computed by adding the main effect of expenditure to the cross-level interaction term for expenditure:

\[ \gamma_{00_1} \text{Av \_expenditure}_k + \gamma_{10_1} \text{Av \_expenditure}_k \times \text{SES}_{ijk} + \gamma_{01_1} \text{Av \_expenditure}_k \times \text{School \_SES}_{ijk} \]

Which may be re-written as:

\[ \text{Av \_expenditure}_k \times (\gamma_{00_1} + \gamma_{10_1} \text{SES}_{ijk} + \gamma_{01_1} \text{School \_SES}_{ijk}) \]

If average expenditure per student assumes a positive value, its total effect on achievement will be positive whenever the second expression in parentheses is positive. Applying the values fitted for the appropriate coefficients and considering the measures of SES and school average SES in the dataset, we verified that increasing average expenditure per student has a positive effect for 96.3 percent of the students.
References


**Table 1: Descriptive Statistics for All Variables**

<table>
<thead>
<tr>
<th>Name of Variable</th>
<th>Variable Description</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
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<td><strong>Student Variables</strong></td>
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<td></td>
<td></td>
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<td>Reading Achievement, 15 years old</td>
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<td>Student Socioeconomic Status</td>
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<tr>
<td>School SES</td>
<td>School Average SES</td>
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<tr>
<td><strong>School Variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Enrollment in Vocational Education</td>
<td>Dummy variable coded 1 if percentage of students enrolled in vocational or technical programs in upper secondary is greater than 50%</td>
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<td>-</td>
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<tr>
<td>School Social Mix</td>
<td>Aggregate from school level of the standard deviation of student SES.</td>
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<td><strong>Country Variables</strong></td>
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<td>Dummy variable, coded 1 if country's percentage of students below their age-appropriate grade is between 10% and 20%; 0 otherwise.</td>
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<td>-</td>
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<td>Dummy variable, coded 1 if country's percentage of students below their age-appropriate grade is between 40% and 50%; 0 otherwise.</td>
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<td>-</td>
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<td>Average Expenditure per student</td>
<td>Logarithm of country's expenditure per student in 1998 for all secondary education (general, technical, vocational), converted into American dollars by the purchased power parity method.</td>
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*The comparison group are countries with repetition rates less than 10%. There is no country with percentage of students below their age-appropriate grade between 20% and 40%.*
<table>
<thead>
<tr>
<th>Country</th>
<th>Average Reading Achievement (by Tertile)</th>
<th>Repeating Rate</th>
<th>SES mix (by Tertile)</th>
<th>Expenditure per Student (by Tertile)</th>
<th>High Enrollment in Vocational Education</th>
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(a) Countries are listed in order of their average scores on the PISA reading achievement.
(b) Non-OECD countries included in PISA study.
(c) Countries included in PISA but excluded from our analysis: Albania, Bulgaria, Liechtenstein and Macedonia.
Table 3: The Within-School (Level-1) Model

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</tr>
<tr>
<td>Student SES</td>
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<td>Level -3</td>
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<td>Intercept, $U_{0k}$</td>
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<td>Level -2</td>
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<tr>
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<tr>
<td>Student SES Slope, $r_{0jk}$</td>
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<td>Level -l</td>
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<tr>
<td>$\epsilon_{jk}$</td>
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*** p < 0.001
Table 4: The Between School (Level-2) Model

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<td>School Average SES</td>
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Random Effects

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<table>
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<th>Level -2</th>
<th>Variance</th>
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<tr>
<td>Intercept, $r_{0jk}$</td>
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<tr>
<td>Student SES Slope, $r_{1jk}$</td>
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*** p < 0.001
Table 5: The Between-Countries (Level-3) Model

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<th>Variables</th>
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<td>Average Expenditure per student $\gamma_{001}$</td>
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<tr>
<td>School Socie1 SES Mix $\gamma_{003}$</td>
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<tr>
<td>Medium Rate of Repetition $\gamma_{004}$</td>
<td>-26.3***</td>
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<td>High Rate of Repetition $\gamma_{005}$</td>
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<td>Intercept $\gamma_{100}$</td>
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<td>Average Expenditure per student $\gamma_{101}$</td>
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<td>SES mix $\gamma_{102}$</td>
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<td><strong>School Average SES/Achievement slope</strong></td>
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*** $p < 0.001$; * $p < 0.05$
Figure 1: The Net Effect of school social Mix in countries on Student Reading Achievement
Figure 2: The Net Effect of Countries’ Emphasis on Vocational Education on Reading Achievement
Quality and Equality in Brazilian Secondary Schools: 
A Multilevel Cross-National School Effects Study

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