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Equality and Equity with  
Large-Scale Assessment  
Data: Brazil as a Case  
Study**

J. Douglas Willms  
L. Tramonte  
Jesús Duarte  
Soledad Bos

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J. Douglas Willms  
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J. Douglas Willms and L. Tramonte work at the University of New Brunswick. Jesús Duarte and Soledad Bos work at the Education Division at the Inter-American Development Bank.

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## ***Abstract***

This study explores the difficulties of evaluating education inequities and inequalities in developing countries and proposes practical definitions of education equity and equality, applying them to the case of Brazil, using the information from the 2007 quality tests (Prova Brasil). The study indicates that more than half of 4th grade children display high deficiencies in their reading abilities, which can affect their academic performance throughout their school career. The deficiencies in reading vary significantly between states and between sub-populations (organized according to parent education level, family socio-economic level and ethnic group). The study found that some of the key school resources that affect learning, such as infrastructure, teachers with higher salaries, well-equipped libraries, access to computers and internet or safe schools, are unequally distributed, particularly affecting children from families with parents who have a low education level, families in poverty or from an Afro-descendant or Asian background. This paper shows that school supply-side factors matter: school resources are related to student achievement and are inequitably distributed. The methodology suggested in this study to estimate the inequalities in the distribution of school resources is easy to apply and may be a useful tool for education policy makers and education sector authorities in Brazil and in other countries from the region.

**JEL Code:** I24

**Key Words:** Education, equality, equity, indicators, school resources, student performance, teacher quality.

## ***Introduction***

A number of studies have suggested that effective schools and school systems tend to have strong systems for monitoring performance (Bishop, 1997, 1999; Lezotte, 1991; Murnane, Sharkey & Boudett, 2005; Scheerens, 1992). Among countries with educational monitoring systems, almost all of them collect data on students' reading and mathematics achievement at certain grade levels. Some jurisdictions also collect data on other student outcomes, such as attendance, school completion, and physical and mental health outcomes. These data are used to monitor the performance of the entire schools system, and in most cases are used to compare provinces or states, school districts and schools in their student performance.

However, educational leaders have become increasingly interested in assessing differences in educational outcomes between sub-populations, and determining the factors that lead to greater equality. For example, they have collected demographic data on students' sex, ethnicity, and family background, as well as data describing various classroom and school processes. The latter can include data describing the intended or official curriculum of the state *versus* the curriculum that is actually taught in the classroom; students' opportunity to learn, including the amount of time devoted to instruction; teachers' expectations for achievement; the quality of teaching; structural features of the schooling system, especially the formal and informal mechanisms governing selection into particular schools and school programs; human and material resources devoted to schooling; the school and classroom learning environment; the nature of interactions among students and teachers; staff morale and commitment; opportunities for professional development; the autonomy of teachers and principals; and parental involvement and satisfaction.

The aim of this paper is describe how these data can be analysed to inform school policy and practice. It distinguishes between measures of ***equality*** and ***equity***, and discusses the prominent issues regarding the use of large-scale national and international assessment data to assess them. It provides a relatively simple structure that can be used by educational administrators for the assessment of equality and equity, and sets out a multi-level statistical

model for the estimation of the relevant statistics. Data from Brazil, which has one of the best educational monitoring systems in Latin America, are used as an example.

### ***Equality and Equity***

The term ***equality*** refers to differences in educational outcomes between sub-populations, such as the difference in the literacy scores of boys and girls, or students from low and high socioeconomic backgrounds.

***Equity*** refers to students' *access* to the school resources and schooling processes that affect educational outcomes. It is concerned with fairness – a just treatment of people from differing sub-populations. This distinction is relevant to social and educational policy in that citizens calling for greater fairness or equity would maintain that students from differing backgrounds should have equivalent opportunities to learn, gauged by their access to schools with similar material and human resources. A case can also be made for an unequal allocation of resources that favours students from less advantaged backgrounds, as the reduction of student vulnerability is associated with greater economic prosperity, lower crime rates, better physical and mental health outcomes, and less dependence on social welfare (Cohen, 1989; Levin, 2009).

### ***Indicators of Student Performance***

Generally, indicators of school performance derive their meaning in one of three ways: by comparisons among jurisdictions, by comparing results to some standard, or by comparisons over time. In making these comparisons, data on student outcomes can be used to describe the distribution of student performance for the entire school system, as well as for separate jurisdictions, such as provinces or states, school districts, and schools. One of the dilemmas in reporting indicators of student achievement is whether to report indicators derived from continuous scores, such as test scores in reading or mathematics, or to report the percentage of students with skills levels above or below one or more critical thresholds.

The first approach takes advantage of the richness of the data. This makes sense for reporting students' achievement test results as considerable effort is spent to reliably estimate each student's position on a continuous scale. In making comparisons, the analyses should describe the *shape* of the distribution of skills, which is usually accomplished with three statistics: the mean, the standard deviation, and the skewness. Multilevel analyses can also discern the extent to which student outcomes vary within and among schools.

However, it is difficult for the policy community to discern whether the magnitude of an observed change in test scores is important in practice. For example, an increase in test scores from 145 to 160 may be statistically significant but is it significant in substantive terms? Some policy makers are familiar with "effect sizes", and in some cases it is possible to report achievement results in a "months of schooling" metric. The use of these metrics can provide a more transparent way to discuss findings derived from continuous measures.

The second approach – reporting the percentage of students that meet or fail to meet some specified criteria – is more relevant to policy-makers if they are concerned about the number of children that are "vulnerable"; that is, children who have relatively poor chances of school success unless there is a significant and sustained school intervention alongside support from their families and other advocates. Some outcomes, such as school completion, are only measured categorically, and many health outcomes, such as childhood obesity are traditionally measured on an ordinal or categorical scale. Policy-makers may also be interested in the percentage of students who are exceptionally capable, as these students are more likely to contribute to social and technical innovations. Statistics based on categorical variables tend to be more transparent, and are more easily used to set goals. For example, a school system may set a goal of decreasing vulnerability from 35% to 30%, which is easier to grasp and explain than increasing average test scores from 145 to 160.

## ***Indicators of Equality and Equity***

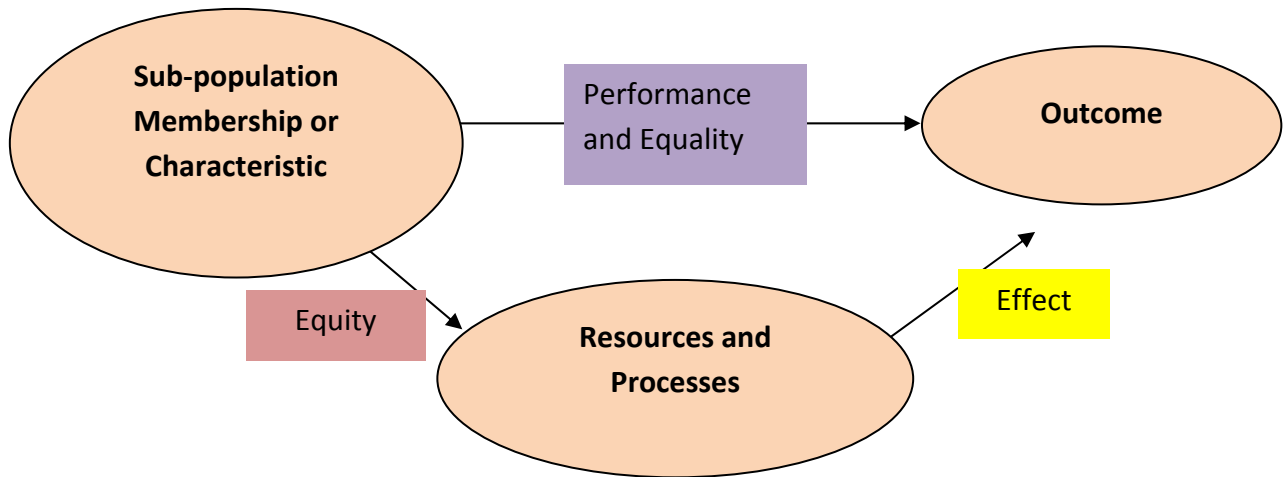
Equality refers to differences in educational outcomes between sub-populations. Its measurement is relatively straightforward; the main challenges are to reliably identify the relevant sub-populations and to accurately measure student outcomes. Equity refers to students' access to the school resources and processes that affect educational outcomes. Therefore, we are not only concerned with differences between sub-populations in their access to school resources and processes, we also need to know which school resources and processes are most important – what are their “effects” on student outcomes? This requirement makes the estimation of equity statistics challenging for at least five reasons.

First, the “effect” associated with a particular school resource or process can differ, depending on the schooling outcome considered. For example, the effects of class size may have a different effect on students' reading performance than on their mathematics performance. Second, an effect can vary among jurisdictions. Nonoyama-Tarumi & Willms (2010) found that the role of material resources was more important than the quality of instruction in some jurisdictions than in others. Third, the effect of a particular resource or process factor can differ in its effect, depending on the sub-population considered. For example, as children are developing their reading skills, being taught in a small class may be more beneficial for boys than for girls. Fourth, reliable measures of school resource and process variables are difficult to obtain. When data are collected from teachers and principals, there is often a large amount of missing data. Fifth, school effects have been notoriously difficult to estimate as school resource and process factors often interact in their effects on student outcomes and they tend to be highly correlated at the school level (Raudenbush & Willms, 1995).

With these challenges in mind, the assessment of equality and equity calls for analyses that consider the effects of resources and processes simultaneously, with consideration of a particular outcome, particular sub-populations, and a reasonably comprehensive set of school resource and process factors. Figure 1 shows a simple path model that distinguishes between performance and equality, school effects and equity. The path labeled “Performance and



Equality” (purple) is concerned with the level of outcomes of each sub-population and the differences between them. The “effect” path (yellow) pertains to the relationship between school and resource factors and student outcomes. Equity (light red) pertains to the relationship between sub-population membership and resources and processes. The practical issues for assessing these relationships are discussed below.



**Figure 1.** A path model for assessing performance and equality, equity and school effects

### Measurement and Definition of Sub-Population Membership or Characteristics

The sub-populations of interest for an analysis of equality and equity depend on the local context. Most school systems, however, are concerned about differences associated with gender, ethnicity, immigrant status, disability or special needs, and socioeconomic status. When discussing the type of measurement of student outcomes, we noted that continuous and dichotomous outcomes have their relative merits and limitations. While some definitions of sub-populations are clearly dichotomous, such as gender, others, such as parents’ level of education or family income, can be measured on a continuous scale. This dictates the preferred type of analysis for estimating equality and equity.

Also, the percentage of students in each sub-population determines how important the sub-population membership is in population terms. For example, a country’s immigrant students may have a greater risk of being vulnerable than non-immigrant students, and

therefore educational policies would aim to reduce the prevalence of vulnerability associated with immigrant status. If the policies were successful, and if the country had a large percentage of immigrants, then the effect on lowering the overall prevalence of vulnerability in the population could be quite substantial. However, if there were relatively few immigrant students in the country, then reducing vulnerability among immigrant students would have a relatively small effect on the level of vulnerability in the full population. We use the term, “population relevance,” to refer to the reduction in prevalence for the full population that would be achieved if the risk in the potentially vulnerable population (e.g., immigrants) were reduced to the same prevalence as that of the non-vulnerable group (e.g., non-immigrants). When considering equality and equity, our main concern is about differences among sub-populations in their outcomes or resources and processes, but we also need to be mindful of the population relevance.

As with continuous test scores, it is often useful to set a cut-point or threshold on a continuous measure that describes a characteristic of the population. One can then talk about those that are vulnerable or not vulnerable. For example, most countries have one or more ways of defining “family poverty”; in the simplest form we could set a threshold for family income and consider families with incomes below that threshold to be poor. The advantage of transforming a continuous sub-population measure into a dichotomous measure is that one can then use the same set of statistics as those used for membership in other sub-populations, such as gender or immigrant status. We will also see that for dichotomous measures there is an intuitive measure of population relevance.

### **Estimating and Reporting Indicators of Equality**

Figure 2 shows the common statistics used for reporting equality for cases when one has a dichotomous or continuous outcome and a dichotomous or continuous measure describing the sub-populations of interest.

When the outcome is continuous and the measure describing the population is continuous (e.g., number of years of parental education), the appropriate statistic for equality is the regression slope or *gradient*. Willms (2006) has used gradients to describe the relationships

between students' test scores and a continuous measure of socioeconomic status (SES) for the countries that participated in the Progress in Reading Literacy Study (PIRLS) and the Programme for International Student Assessment (PISA). The magnitude of the slope is a measure of equality, with more gradual slopes indicating greater equality. The population relevance is gauged by R-squared, the proportion of variance explained by SES. When R-squared is greater, SES has greater population relevance.

		Differences among Sub-Populations		Population Relevance	
		Outcome or Resource/Process Factor		Outcome or Resource/Process Factor	
		Continuous	Dichotomous	Continuous	Dichotomous
Sub-Population Membership or Characteristic	Continuous (e.g., parents' education)	Regression Slope	Odds-Ratio	R-squared	Cox & Snell R-squared
	Dichotomous (e.g., disability)	Difference In Means	Relative Risk, Odds-Ratio, or Difference in Percentage	R-squared	Population Attributable Risk

**Figure 2.** Statistics for assessing equality and equity

When the outcome is continuous and the measure describing the population is dichotomous (e.g., males and females) equality can be expressed simply as the difference in mean scores. R-squared is an appropriate measure of population relevance.

When the outcome is dichotomous and the measure describing the population is continuous, the odds-measure is an appropriate measure of equality. An odds-ratio, as the name implies, is the ratio of the "odds" of failure (or success) in one sub-population to that of another sub-population. For example, if 75% of boys successfully completed secondary school, we would say that their odds of school completion was 75% (the percentage successfully completing school) divided by 25% (the percentage *not* successfully completing school), or 3.0. Similarly, if 80% of girls successfully completed secondary school, their odds would be 80/20, or

4.0. The odds-ratio, then, is  $3.0/4.0$ , or  $0.75$ . We would say that the odds of boys completing secondary school are 75% of the odds for girls. One can estimate the odds-ratio with a logistic regression model, regressing the dichotomous outcome on either a continuous measure denoting sub-population characteristics, such as number of years of parental education, or on a dichotomous measure such as male or female. When the measure describing the population is continuous, the odds-ratio denotes the change in odds associated with a one-unit change in the continuous measure denoting the sub-population characteristic. For example, if the odds-ratio for “number of years of parental education” was  $1.05$ , we would say that the odds of completing secondary school increased by 5% for each one-year increase in parental education. The population relevance is gauged by the Cox and Snell R-squared.

When both the outcome and the measure describing the population are dichotomous, three different statistics could be used to report levels of equality. The simplest is a difference in percentages. In the example above in which 75% of boys and 80% of girls completed secondary school, we could simply report that the difference in secondary school completion rate was 5%. We could also report the difference as an odds-ratio; in this case it is  $0.75$ . The third statistic is relative risk, which is usually used to express the risk of failure. It is the ratio of the prevalence of vulnerability in one sub-population to the prevalence in the other sub-population. In the example above, the risk of boys *not* completing secondary school is 30%, and for girls it is 20%, so the relative risk is  $1.5$ . We would say that the risk of boys not completing secondary school is one-and-a-half times that of girls.

The measure of population relevance when both the outcome measure and the measure describing the population are dichotomous is the “population attributable risk”. It is the proportion of the total occurrence of an outcome, such as low reading scores, that is associated with membership in the potentially vulnerable population. For example, if 20% of students in a population had low reading scores, and the prevalence was higher among immigrants than non-immigrants, we could ask, “By what fraction would the prevalence of vulnerability in the population decrease if we could reduce the prevalence of vulnerability among immigrants to the same level as that of non-immigrants?” This fraction is population

attributable risk. Note that the population attributable risk depends not only on the relative risk associated with membership in the vulnerable group, but also on the relative size of the vulnerable group.

### **Measurement and Definition of School Resources and Processes**

We also want to assess whether a vulnerable sub-population has comparable access to key school resources and processes. Levels of equity can be assessed with the same two sets of statistics applied to factors describing resources and processes – the difference in mean scores and the proportion of variance explained for continuous measures and relative risk and population attributable risk for dichotomous measures.

One of the challenges, noted above, is that it is difficult to determine which resource and process variables are most important. Our understanding of the effects of certain school resource and process variables is limited. Large-scale national and international studies can shed light on which factors may be important, but cross-sectional studies cannot discern the effect that one might achieve by increasing the level of a potential equity factor. Thus, the term “school effect” is used rather loosely in this context; it cannot be elevated to the status of a “causal effect” without a randomized study or at least a longitudinal study in which the key factors of interest vary from school to school and over time. With this caution in mind, in this paper we conduct multilevel analyses, regressing students’ reading achievement on a set of resource and process variables available with the Brazilian data. Later we comment on the adequacy of these variables for assessing equity.

### ***An Example based on Brazilian Data***

We use national data from the Brazilian Ministry of Education’s *Prova Brazil 2007* to provide examples of the measurement of performance and equality, school effects, and equity. The data set includes data for 2,315,152 grade 4 students and 1,800,038 grade 8 students. We used only the data for the grade 4 students and their respective schools. Among the grade 4 students, 2,306,054 students had valid test scores in reading, and 1,972,233 had valid questionnaire data and test scores.

## Indicators of Student Performance

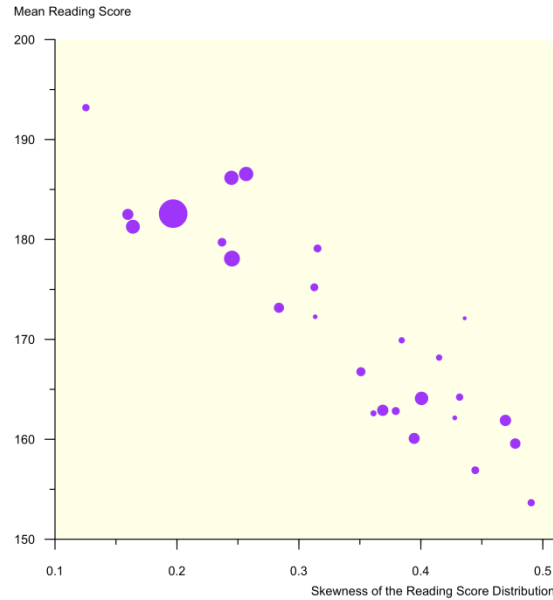
Table 1 shows the statistics for students' reading achievement at Grade 4 for Brazil and for each state. The average reading score for grade 4 students in Brazil was 176, with a standard deviation of 41. The distribution was positively skewed, with a skewness of 0.321. The average reading score varied significantly among states, ranging from 154 in Rio Grande do Norte to 193 in Distrito Federal. The standard deviation also varies significantly among states, and states with higher mean scores have larger standard deviations; the correlation is 0.80.

The skewness is positive in all states, with higher scoring states having a less skewed distribution; the correlation is -0.90. This relationship, which is shown in Figure 3, is important as it suggests that even in low-scoring states a significant percentage of students have relatively high scores.

We dichotomized the reading scores based on the Prova Brazil levels of performance associated with the interval scores. Students with reading scores at Level 2 or lower (a score less than 175) were considered to have low reading scores. With this cut-point, 51.6% of Brazilian Grade 4 students had low reading scores. Children who perform at Level 3 (scores ranging from 175 to 199) can read more complex text and understand texts presented in different formats, such as newspaper articles, extracts from an encyclopedia, a long poem or a long narrative. With this criterion for 'vulnerability', the percentage of students deemed vulnerable varies markedly across states, from 32% in Distrito Federal to 74% in Rio Grande do Norte. The correlation between mean reading scores and percentage vulnerable at the state level is -0.999.

**Table 1.** Descriptive statistics for reading performance in Brazil, by state. **Source:** Prova Brazil 2007

	Mean	Standard Deviation	Skewness	Percent Vulnerable	Percent Variance Between Schools
<b>Brazil</b>	<b>176</b>	<b>41</b>	<b>0.32</b>	<b>52%</b>	<b>17.0%</b>
Rondônia	170	37	0.38	58%	7.3%
Acre	172	37	0.31	55%	12.6%
Amazonas	167	37	0.35	61%	11.9%
Roraima	172	37	0.44	56%	9.7%
Pará	163	34	0.37	66%	8.7%
Amapá	162	36	0.43	67%	5.7%
Tocantins	168	38	0.42	60%	12.3%
Maranhão	160	36	0.48	69%	13.7%
Piauí	164	36	0.43	65%	13.1%
Ceará	162	38	0.47	66%	12.5%
Rio Grande do Norte	154	35	0.49	74%	10.1%
Paraíba	163	36	0.38	65%	12.0%
Pernambuco	160	36	0.40	68%	9.3%
Alagoas	157	34	0.45	72%	9.2%
Sergipe	163	35	0.36	66%	10.0%
Bahia	164	36	0.40	64%	10.7%
Minas Gerais	187	43	0.26	41%	16.7%
Espírito Santo	180	39	0.24	47%	11.0%
Rio de Janeiro	178	40	0.25	48%	13.5%
São Paulo	183	43	0.20	44%	12.4%
Paraná	186	39	0.25	40%	11.1%
Santa Catarina	183	39	0.16	43%	11.1%
Rio Grande do Sul	181	39	0.16	44%	12.3%
Mato Grosso do Sul	179	38	0.32	48%	13.6%
Mato Grosso	175	38	0.31	52%	10.0%
Goiás	173	38	0.28	54%	8.0%
Distrito Federal	193	39	0.13	32%	9.2%



**Figure 3.** Mean grade 4 reading scores versus skewness of the distribution. Source: Prova Brazil 2007.

### Indicators of Equality and Equity

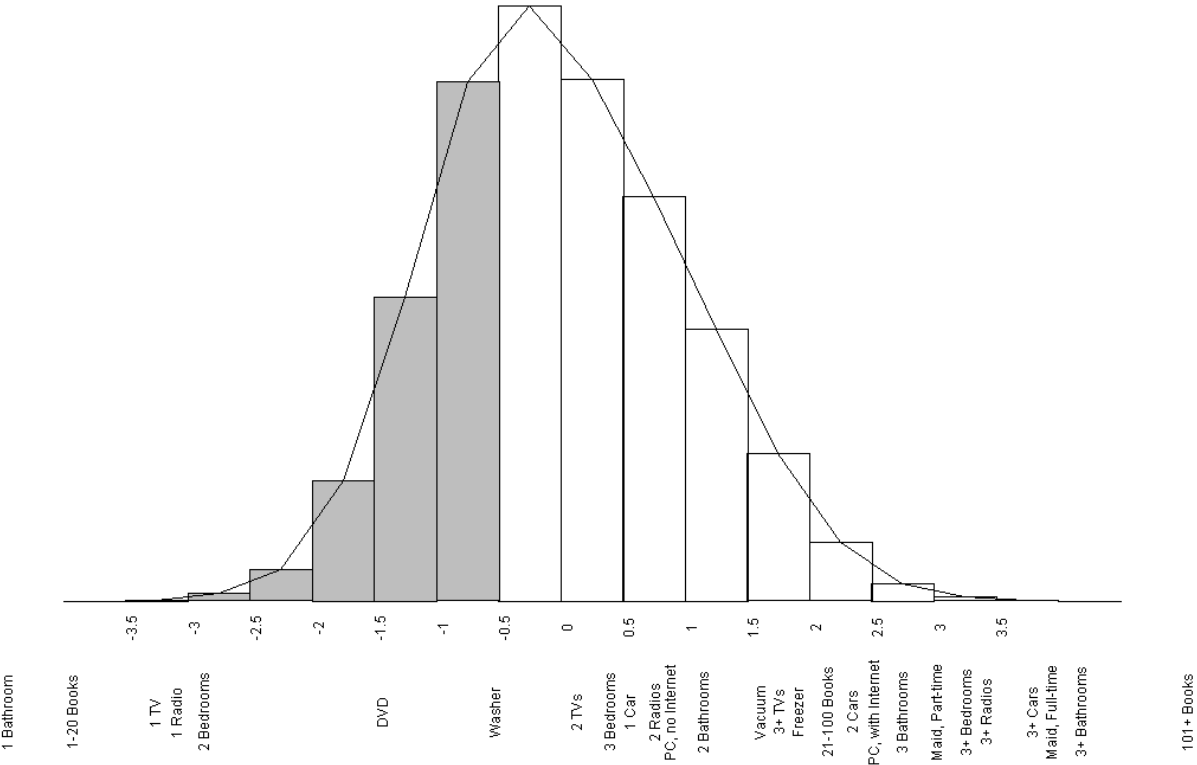
For our analysis of equality and equity in Brazil we constructed seven measures describing sub-population membership as follows:

**Parents' Education.** Students were asked about the highest level of education their parents had attained. We constructed a measure of parental education that was coded one if at least one parent had completed the 8<sup>th</sup> series (approximately 9<sup>th</sup> grade) or higher, and zero otherwise. A substantial number of students were missing data on this measure, and therefore for regression analyses we constructed a dummy variable denoting whether or not a child was missing data on parental education.

**Poverty.** We used a Samejima graded-response model (Samejima, 1997) to scale the scores on a measure of home possessions. For example, students were asked about how many books they had in their home, with three possible responses: (0) none, (1) 1-20 books, (2) 21-100 books, and (3) more than 100 books. This analysis yields estimates of the “discrimination” and “difficulty” of each response for each item, and an overall measure of affluence. The distribution of scores on this measure is shown in Figure 4 with



the difficulty of each item portrayed on the scale. The scale was standardized to have a mean of zero and a standard deviation of one. For example, having between one and 20 books in the home is a very “easy” item; its position on the scale is about -4.0 and only a small fraction of students have scores below that level. Having between 21 and 100 books in the home is more difficult; its level of difficulty is 1.8 and only about 4% of the students have scores above that value. Having more than 100 books is very rare, with a score of about 4.5; less than one in 1000 students have scores above this value.



**Figure 4.** The distribution of scaled scores of affluence and associated item difficulty scores

Having a washing machine had a scaled score of -0.465. This is the point on the scale at which 50% of the population had a washing machine. Students with scaled scores less than or equal to -0.465 were classified as living in poverty. With this cut-point, 29.2% of the students were considered living in poverty. Clearly, as with any measure, the choice of

cut-points is arbitrary. However, with this approach the cut-point is anchored on something meaningful.

**Ethnicity.** The questionnaire included five categories of ethnicity. These were coded as dummy variables, with one indicating the child belonged to a particular ethnic group, and zero otherwise. The percentages in the five sub-populations were:

White	35.1%
Brown	46.4%
Black	11.5%
Asian	3.1%
Indigenous	3.9%

We also constructed a dummy variable denoting the child's sex, with females coded 1 and males 0. 49.8% of the sample was female and 51.2% was male.

### **School Resources and Processes**

The teacher and school questionnaires provided data that could be used to construct a number of classroom- and school-level variables to assess equity. These are described below.

**Teachers' level of education.** A dummy variable indicates whether or not a teacher has tertiary education (paedagogical degree or other degree).

**Teachers' salary.** A dummy variable denotes whether a teachers' salary, not including income from other sources, was above or below the national median.

**Teachers feel supported.** Teachers were asked 15 questions regarding the extent to which they felt supported in their work. Their responses on a Likert scale were scaled as a continuous measure. We constructed a dummy variable which denotes whether a teacher's score was in the top quartile (coded 1) or the bottom three quartiles (coded 0).

**High level of ICT.** The school questionnaire included 11 questions about the availability of various types of equipment relevant to interactive communication technology. The

responses were scaled on a continuous scale. We constructed a dummy variable which denotes whether the score was in the top quartile (coded 1) or the bottom three quartiles (coded 0).

**Infrastructure.** The school questionnaire included 18 questions describing the quality of school infrastructure, such as condition of the building, windows, bathrooms, etc. The scores were scaled using a Samejima graded-response model. Schools in the highest quartile were considered to have a strong physical infrastructure.

**Well-equipped library.** The school questionnaire included 5 questions regarding the condition and quality of library materials. The responses were scaled on a continuous scale. We constructed a dummy variable which denotes whether the score was in the top quartile (coded 1) or the bottom three quartiles (coded 0).

**Safe School.** The school questionnaire included 6 questions relevant to school safety. The responses were scaled on a continuous scale, and we constructed a dummy variable which denotes whether the score was in the top quartile (coded 1) or the bottom three quartiles (coded 0).

We estimated a three-level hierarchical logistic regression model, with students nested within classrooms at Level 1, classrooms nested within schools and Level 2, and schools at Level 3. The results are shown in Table 2. Our aim was to discern the relative effect of the classroom and school factors, after controlling for the demographic factors at the student level.

**Table 2.** Odds-ratios for low reading scores associated with student, class and school-level factors.  
**Source:** Prova Brazil 2007.

	<b>Odds-Ratio</b>	<b>Confidence Interval</b>
<b>Student Level</b>		
<b>Female (Male is reference category)</b>	<b>0.661</b>	(0.658,0.666)
<b>Ethnicity (White is reference category)</b>		
<b>Brown</b>	<b>0.983</b>	(0.976,0.990)
<b>Black</b>	<b>1.519</b>	(1.503,1.535)
<b>Asian</b>	<b>1.315</b>	(1.292,1.338)
<b>Indigenous</b>	<b>0.979</b>	(0.963,0.994)
<b>Low Parental Education</b>	<b>1.470</b>	(1.459,1.482)
<b>Poverty</b>	<b>1.148</b>	(1.141,1.115)
<b>Classroom Level</b>		
<b>Teachers' Level of Education</b>	<b>0.983</b>	(0.973,0.993)
<b>Teachers' Salary</b>	<b>0.803</b>	(0.793,0.813)
<b>Teachers Feel Supported</b>	<b>0.979</b>	(0.963,0.995)
<b>School Level</b>		
<b>High Level of ICT</b>	<b>0.788</b>	(0.773,0.804)
<b>Strong Physical Infrastructure</b>	<b>0.855</b>	(0.837,0.874)
<b>Well-Equipped Library</b>	<b>0.801</b>	(0.787,0.814)
<b>Safe School</b>	<b>0.907</b>	(0.886,0.927)

The results indicate that the odds of a girl having a low reading score are about two-thirds that of boys. Brown and indigenous students had about the same likelihood as white students to have a low reading score; the odds ratios are 0.983 and 0.979. However, the odds of Black students having a low reading score were almost one-and-a-half times that of White students. Asian students were also at greater risk of low achievement; the odds-ratio is 1.315.

Note that these results pertain to the risk to low reading achievement after controlling for family socioeconomic status. The results indicate that the odds of having a low reading score for students whose parents had a low level of education were about one-half times that of their peers whose parents had a high level of education. Students living in poverty were also at greater risk; the odds-ratio was 1.148.

Among the three classroom-level variables, teachers' salary had the strongest relationship with low reading achievement, with an odds-ratio of 0.803. This indicates that the odds of having a low reading score for a child with a teacher whose salary was above the

median was only about four-fifths that of a teacher with a salary below the median. The other two factors – teachers’ level of education and teachers feeling supported in their work had statistically significant but very small effects.

The school-level resource factors had stronger effects, with odds-ratios of 0.788 for ICT, 0.801 for a well-equipped library, and 0.855 for a strong infrastructure. School safety was also important, with an odds-ratio of 0.907.

These results give an indication of the relative risk associated with each of these school factors. The equity question is concerned with the extent to which disadvantaged sub-population have access to these resources.

### **Estimating and Reporting Indicators of Performance, Effects, Equality and Equity**

Table 3 provides the relevant statistics on performance and equality, effects, and equity for the Prova Brazil data. The table is intended as a standard approach for reporting these results. The colours correspond to those used in Figure 1 for describing the model: purple for performance and equality, yellow for effects, and light red for equity.

The first column specifies the percentage of the population in each of the sub-populations. For example, 60% of the population had parents with low parental education, while 29.2% were classified as living in poverty. The second column indicates the percentage in each sub-population with low reading scores. In the full population, 51.6% has low reading scores, but among those with low parental education the prevalence is higher – 56.2%. Among those living in poverty, the prevalence is higher still – 60.4%. The third column presents the two equity statistics discussed above: relative risk (RR) and population attributable risk (PAR). Among students with low parental education, the RR is 1.37, indicating that the risk of these students having low reading achievement is 1.37 times that of their peers. The PAR is 18%. This means that if one could improve the reading results among those with low parental education, it would reduce the overall level of vulnerability, which is 51.6%, by 18%.

**Table 3.** A Standard Table for Reporting Performance, Equality and Equity

	Sub-Population (%)	Low Reading Scores (%)	Equality RR [PAR]	Equity RR [PAR]						
				Teachers' Level of Education	Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-equipped Library	Safe School
<b>Resource (%)</b>				<b>44.9</b>	<b>57.4</b>	<b>88.8</b>	<b>23.4</b>	<b>16.6</b>	<b>37.3</b>	<b>15.2</b>
<b>Effect Odds-ratio</b>				<b>0.98</b>	<b>0.80</b>	<b>0.98</b>	<b>0.79</b>	<b>0.85</b>	<b>0.80</b>	<b>0.91</b>
<b>RR [PAR]</b>	100.0	51.6		0.96 [-2]	0.82 [-11]	0.96 [-3]	0.83 [-4]	0.86 [-2]	0.86 [-6]	0.89 [-2]
<b>Low Parental Education</b>	60.0	56.2	1.37 [18]	0.96 [-2]	0.86 [-9]	1.00 [-0]	0.84 [-11]	0.88 [-8]	0.89 [-7]	0.84 [-10]
<b>Poverty</b>	29.2	60.4	1.26 [7]	0.92 [-2]	0.72 [-9]	1.00 [0]	0.65 [-11]	0.74 [-8]	0.75 [-8]	0.74 [-8]
<b>White</b>	35.1	47.3	0.88 [-4]	1.05 [2]	1.07 [3]	1.00 [0]	1.22 [7]	1.15 [5]	1.16 [5]	1.09 [3]
<b>Brown</b>	46.4	51.2	0.99 [-1]	0.98 [-1]	0.96 [-2]	1.00 [-0]	0.89 [-5]	0.92 [-4]	0.92 [-4]	0.96 [-2]
<b>Black</b>	11.5	64.4	1.29 [3]	0.95 [-1]	0.96 [-0]	0.99 [-0]	0.89 [-1]	0.91 [-1]	0.91 [-1]	0.92 [-1]
<b>Asian</b>	3.1	59.2	1.15 [0]	0.99 [-0]	0.95 [-0]	1.00 [-0]	0.92 [-0]	0.96 [-0]	0.94 [-0]	0.95 [-0]
<b>Indigenous</b>	3.9	50.1	0.97 [0]	0.98 [-0]	0.98 [-0]	0.99 [-0]	0.94 [-0]	0.96 [-0]	0.95 [-0]	0.99 [-0]

The RR for poverty is 1.26, but the PAR is only 7%. While the RR for poverty is close to that of low parental education, the PAR is considerably smaller. This is because the strength of the relationship between reading and parental education is much stronger than the relationship between reading and poverty (see Table 2). Comparing the results across sub-populations, these results suggest that there are four sub-populations with relative large RR: those with low parental education, those living in poverty, Blacks and Asians.

The first three rows of the table provide results relevant to the effects of the resource variables. The first row simply shows the percentage of the full population that has access to the resource; for example, 44.9% have teachers with a high level of education, 57.4% have teachers with a high salary, etc. The second column shows the odds-ratios for low reading achievement associated with each factor, after controlling for students' background, and given all of the other factors in the model are held constant. For example, the odds of having poor reading achievement for a student in a school with a strong physical infrastructure are only 85% that of their peers in schools with a weak infrastructure, with demographic and other factors held constant. These results were derived from the regression results presented in Table 2 above. The third row presents the RR and PAR for each factor. Note that these results are derived solely from the bivariate relationships between reading achievement and each equity factor. As one might expect, these mirror the multivariate results. In the case of school infrastructure, for example, the RR is 0.86, indicating that students in schools with a strong infrastructure are only 86% as likely to have low reading achievement as their peers in schools with a poor infrastructure. The PAR for strong infrastructure is -2%. This suggests that if all students were in schools with a strong physical infrastructure, vulnerability would be reduced by 2%. The largest PARs are for teacher's salaries (-11%) and having a well-equipped library (-6%).<sup>1</sup>

The equity results are presented in the light red cells in the last 7 rows of Table 3. For these results the equity factor, such as a high teacher salary, is treated as the outcome or response variable. The question is, "To what extent does a potentially vulnerable sub-population, such as students with low parental education, have access to schools with high average teacher salary, for example, or to schools with a well-equipped library?" The RR results for students with low parental education indicate that they have the least access to schools with a high level of ICT and to safe schools; the RR is 0.84 for both factors. This sub-population also has less access to schools with a high teacher salary (RR=0.86), schools with a strong

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<sup>1</sup> The PARs are negative for these factors, as they have been coded as *protective* factors (e.g., a *high* level of teachers' education or a *well-equipped* library) rather than as *risk* factors (e.g., poverty). However, the results can be interpreted in a similar fashion.

infrastructure (RR=0.88) and schools with a well-equipped library (0.89). The PARs are also shown for these bivariate relationships. For example, the PAR for well-equipped library and low parental education is -7%. This means that if students with low parental education had the same access to schools with well-equipped libraries, the overall prevalence of student access to well-equipped libraries would increase by 7%.

The equity results suggest that there are five resource factors that poor students and students from low parental education have less access to than their higher SES peers: schools with a high teacher salary, a high level of ICT, a strong infrastructure, and a well-equipped library. Low SES students are also less likely to attend safe schools. The findings associated with ethnicity are less pronounced. Whites have greater access to the resources that are related to high achievement; if we exclude teacher support, the RRs range from 1.05 to 1.22. The RRs for the other ethnic groups range from 0.89 to 1.00. Taken together, these results indicate that inequities in access to important school resources in the Brazilian system have a stronger relationship to socioeconomic factors than to ethnicity.

These results can vary by state. Table 3 is presented as a template for examining performance, equality and equity in a standardized way. The results for each Brazilian state are presented in Appendix Table 1 to 27.

## ***Summary and Discussion***

### ***Results and Implications for Brazil***

This paper sets out a model for assessing student performance, equality, and equity using large-scale national monitoring systems. Data from the Brazilian Ministry of Education's *Prova Brazil 2007* were used to provide examples. The analyses yielded a number of findings relevant to educational policy in Brazil.

**(1) About 52% of Brazilian Grade 4 students were 'vulnerable' in the sense that their reading performance was at Level 2 or lower on the six-level *Prova Brazil* scale.**

A critical transition for school-age children is the transition from 'learning-to-read' to 'reading-to-learn'. If children are not able to read with ease and understand what they have



read by the fourth grade, they are less able to take advantage of learning opportunities that lie ahead. In most school systems, the emphasis of the curriculum changes after grade 3 or 4; the requirements for reading proficiency increase and very little time is dedicated to teaching children *how* to read. Therefore, most children who fall behind during the primary years rarely catch up (Torgesen, 1998) and continue to be struggling readers throughout their school career (Beswick & Willms, 2008; Francis *et al.*, 1996; Juel, 1988). The findings in this study are consistent with the results from the 2009 Programme for International Student Assessment (PISA), which indicated that 77% of Brazilian 15-year olds had reading scores at or below Level 2, and 50% had scores at or below Level 1 on the six-level international scale.

**(2) The prevalence of vulnerable children varies markedly across the 27 states of Brazil, from 32% in Distrito Federal to 74% in Rio Grande do Norte.**

This finding indicates that a large degree of the inequalities in Brazil are entrenched geographically, and therefore are to a large degree associated with inequalities in resources at the local level.

**(3) There are large inequalities in reading performance associated with four sub-populations: children whose parents have a low level of education, children living in poverty, Blacks and Asians.**

Generally, the inequalities associated with the two socioeconomic factors – low parental education and poverty – were greater than those associated with ethnicity. The largest inequality was associated with poverty: 60% of children living in poverty were vulnerable compared with 52% in the full population.

**(4) There are inequities among sub-populations in their access to some of the key resources that affect student learning. These include: schools with a high teacher salary, a high level of ICT, a strong school infrastructure, and a well-equipped library. Also, poor students were less likely to be in safe schools.**

The study constructed a number of variables from *Prova Brazil* that were potentially related to student achievement. The findings of an hierarchical regression analysis indicated

that the above five factors had moderate to strong relationships with reading achievement. Two factors, teachers' level of education and teachers feelings of being supported in their work had a positive but relatively weak relationships with reading achievement. This two-step process of asking first "What resources and process factors are most important?" and then asking, "To what extent do various sub-populations have access to these resources and process?" suggest that in Brazil many of the inequalities among sub-populations are associated with inequities in access to some basic school and classroom resources.

### ***Implications for Monitoring in Other Countries***

When we examine test scores from PISA or national assessments such as *Prova Brazil*, we tend to think of the results as a reflection of what children have learned at school, and that their achievement is largely determined by the quality of teaching, the curriculum, and various educational policies and practices. However, the test scores represent the *cumulative result* of children's learning at home and at school since birth, or arguably even earlier. Moreover, children's learning potential is to a large extent established during the pre-school years and is affected by family and community resources. Therefore, many of the inequalities we observe in a school system are evident when children begin school at age 5 or 6, and are entrenched through long-standing economic, social, and political forces. After, children enter school, inequalities can be exacerbated in two ways: first, through factors that contribute to the concentration of students of low socioeconomic status or low ability students into particular schools and school programs, and second, through an inequitable distribution of school resources and processes.

In earlier work, Willms (2006, 2010) defines two types of segregation: horizontal and vertical. A horizontally segregated system is one in which students from differing socioeconomic backgrounds are separated into different schools or school programs. In most school systems, there is some degree of horizontal segregation associated with residential segregation within cities and with socioeconomic differences between urban and rural areas. Private schooling can also contribute to the separation of students based on their socioeconomic status, as higher-income families are more likely than poor families to enrol

their child in a private school. A vertically segregated school system is one in which schools vary markedly in their performance as a result of policies and practices that select the most talented students into high status schools, or by tracking students within schools into certain school programs or streams. Both types of segregation are undesirable and lead to greater inequalities.

Latin American school systems tend to be both horizontally and vertically segregated. Willms's (2010) analyses of the PISA 2006 data indicated that in Brazil 35% of the variation in SES was between schools, which was comparable to Argentina (36%) and Mexico (35%), but lower than Chile (50%). This is a relatively high level of horizontal segregation. The levels of vertical segregation were even higher: 47% for Argentina, 47% for Brazil, 51% for Chile, and 40% for Mexico. One of the limitations of this study is that the *Prova Brazil 2007* data do not include rural schools, and therefore any estimate of horizontal or vertical segregation would be an underestimate. We also expect, therefore, that the estimates of inequalities and inequities are lower than we would expect if the data covered the full population. However, these analyses do indicate that school resource factors, such as having a strong school infrastructure, are correlated negatively with student SES, and therefore are associated with the negative effects of horizontal segregation. In simple terms, low SES student are disadvantaged because they have fewer educational resources at home and then further disadvantaged because they attend schools with fewer material and human resources.

Debates about educational funding in low-income countries have been concerned with the relative merits of demand versus supply-side interventions. Demand-side interventions aim to increase student attendance and performance through stipends, cash transfers conditional on attendance, targeted vouchers, and other incentives such as free meals (Patrinos, 2007). In contrast, supply-side interventions strive to improve the quality of schools by increasing school resources and improving the quality of classroom instruction. Some economists contend that demand-side interventions are more cost-effective. Coady and Parker's (2004) evaluation of the *Progresá*, a program aimed at increasing educational access of poor children in Mexico, supported demand-side interventions. However, their primary measure of *supply* was the

distance of the child from the school, which was negatively related to enrollment, and the authors estimated the costs of building new schools to reduce the distance. Of course, the demand-side measure of incentives had a stronger effect and cost less. Their research, and to a large extent this work as well, suffer from a lack of a comprehensive set of school resource and process measures. This paper shows clearly that supply-side factors matter: school resources are related to school achievement and are inequitably distributed. However, perhaps the most important factor, quality teaching, is not adequately captured with measures such as teachers' level of education, salary, or years of experience.

Our view is that children deserve equal access to high-quality schooling, even if it means spending more money in poor areas. Increasing student attendance through incentives can have only marginal returns in student performance if schools have poor quality teaching or lack basic resources.

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## Equality-Equity Tables for Brazilian Regions

**Appendix Table 1.** Results on Quality, Equality and Equity for Rondônia. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>56.6</b>	<b>73.6</b>	<b>84.2</b>	<b>16.9</b>	<b>7.5</b>	<b>34.1</b>	<b>21.6</b>
<b>Effect RR[PAR]</b>				1.00 [0]	0.90 [-8]	0.95 [-4]	0.95 [-1]	0.88 [-1]	0.94 [-2]	0.97 [-1]
<b>Low Parental Education</b>	61.4	62.8	1.33 [17]	1.03 [2]	0.91 [-6]	1.01 [0]	0.90 [-7]	0.66 [-26]	0.90 [-6]	0.78 [-15]
<b>Poverty</b>	29.9	62.7	1.12 [3]	1.03 [1]	0.92 [-2]	0.99 [0]	0.92 [-3]	0.75 [-8]	0.90 [-3]	0.78 [-7]
<b>White</b>	31.6	59.1	1.03 [1]	1.04 [1]	1.01 [0]	1.01 [0]	1.08 [2]	1.10 [3]	1.05 [1]	0.96 [-1]
<b>Brown</b>	49.8	55.2	0.90 [-5]	0.99 [-1]	1.00 [0]	0.99 [0]	1.00 [0]	0.95 [-3]	1.00 [0]	1.03 [1]
<b>Black</b>	11.8	67.3	1.18 [2]	0.95 [-1]	0.96 [0]	0.98 [0]	0.88 [-1]	0.92 [-1]	0.92 [-1]	1.04 [1]
<b>Asian</b>	3.2	61.3	1.06 [0]	0.96 [0]	1.01 [0]	0.97 [0]	0.95 [0]	0.93 [0]	0.89 [0]	0.94 [0]
<b>Indigenous</b>	3.5	57.4	0.99 [0]	1.06 [0]	1.05 [0]	1.03 [0]	0.95 [0]	1.10 [0]	1.01 [0]	0.97 [0]

**Appendix Table 2.** Results on Quality, Equality and Equity for Acre. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>52.5</b>	<b>63.2</b>	<b>85.9</b>	<b>8.4</b>	<b>15.4</b>	<b>30.9</b>	<b>13.0</b>
<b>Effect RR[PAR]</b>				0.90 [-5]	0.92 [-5]	1.05 [4]	0.93 [-1]	0.95 [-1]	0.97 [-1]	0.81 [-2]
<b>Low Parental Education</b>	55.4	59.6	1.27 [13]	0.88 [-7]	0.92 [-4]	0.99 [0]	0.75 [-16]	1.09 [5]	0.92 [-4]	0.74 [-17]
<b>Poverty</b>	36.3	59.9	1.14 [5]	0.85 [-6]	0.85 [-6]	1.02 [1]	0.79 [-8]	0.89 [-4]	0.88 [-5]	0.67 [-14]
<b>White</b>	26.0	57.8	1.06 [2]	1.00 [0]	0.99 [0]	1.00 [0]	0.91 [-3]	0.97 [-1]	0.99 [0]	0.98 [0]
<b>Brown</b>	56.8	52.1	0.88 [-7]	1.00 [0]	0.98 [-1]	1.01 [1]	1.19 [10]	0.98 [-1]	1.03 [2]	0.95 [-3]
<b>Black</b>	10.6	65.7	1.22 [2]	0.98 [0]	1.05 [1]	0.97 [0]	0.74 [-3]	1.13 [1]	0.94 [-1]	0.96 [0]
<b>Asian</b>	3.7	55.0	1.00 [0]	1.00 [0]	1.06 [0]	1.03 [0]	1.10 [0]	1.06 [0]	1.14 [1]	1.36 [1]
<b>Indigenous</b>	3.0	54.9	0.99 [0]	1.08 [0]	0.97 [0]	0.97 [0]	0.93 [0]	0.85 [0]	0.81 [-1]	1.27 [1]



**Appendix Table 3.** Results on Quality, Equality and Equity for Amazonas. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>25.4</b>	<b>45.7</b>	<b>86.5</b>	<b>14.5</b>	<b>12.9</b>	<b>32.6</b>	<b>10.3</b>
<b>Effect RR[PAR]</b>				0.99 [0]	0.96 [-2]	0.93 [-7]	0.95 [-1]	0.92 [-1]	0.91 [-3]	0.90 [-1]
<b>Low Parental Education</b>	51.1	67.5	1.28 [13]	0.92 [-4]	0.89 [-6]	0.99 [-1]	0.83 [-9]	0.79 [-12]	0.81 [-11]	0.75 [-14]
<b>Poverty</b>	29.7	64.2	1.07 [2]	0.84 [-5]	0.83 [-5]	0.99 [0]	0.80 [-6]	0.77 [-7]	0.83 [-5]	0.74 [-8]
<b>White</b>	23.9	65.5	1.09 [2]	1.08 [2]	1.03 [1]	1.00 [0]	1.01 [0]	1.09 [2]	1.00 [0]	1.03 [1]
<b>Brown</b>	56.6	57.3	0.86 [-9]	0.94 [-3]	0.98 [-1]	0.99 [-1]	1.08 [4]	0.88 [-7]	0.99 [-1]	1.03 [2]
<b>Black</b>	11.8	71.3	1.19 [2]	0.96 [0]	1.01 [0]	1.00 [0]	0.86 [-2]	1.09 [1]	0.95 [-1]	0.91 [-1]
<b>Asian</b>	3.4	66.8	1.09 [0]	1.14 [0]	1.11 [0]	1.01 [0]	0.94 [0]	1.23 [1]	1.01 [0]	0.96 [0]
<b>Indigenous</b>	4.3	59.8	0.97 [0]	1.01 [0]	0.90 [0]	1.04 [0]	0.90 [0]	0.97 [0]	1.19 [1]	0.94 [0]

**Appendix Table 4.** Results on Quality, Equality and Equity for Roraima. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>43.3</b>	<b>87.8</b>	<b>76.4</b>	<b>8.5</b>	<b>6.9</b>	<b>29.6</b>	<b>11.3</b>
<b>Effect RR[PAR]</b>				0.97 [-1]	0.92 [-8]	1.03 [2]	0.69 [-3]	1.10 [1]	0.93 [-2]	0.97 [0]
<b>Low Parental Education</b>	44.9	63.9	1.35 [14]	1.04 [2]	0.99 [0]	1.00 [0]	0.67 [-18]	1.10 [4]	0.97 [-1]	1.23 [10]
<b>Poverty</b>	30.9	60.2	1.11 [3]	1.04 [1]	0.95 [-1]	1.05 [2]	0.54 [-17]	1.12 [4]	0.97 [-1]	1.15 [4]
<b>White</b>	23.8	60.3	1.10 [2]	0.96 [-1]	1.02 [0]	1.01 [0]	0.99 [0]	0.98 [-1]	0.96 [-1]	1.09 [2]
<b>Brown</b>	59.3	51.9	0.84 [-11]	1.04 [2]	0.99 [0]	1.00 [0]	1.13 [7]	0.86 [-9]	1.12 [6]	0.93 [-4]
<b>Black</b>	11.0	66.0	1.21 [2]	0.99 [0]	1.01 [0]	1.02 [0]	0.80 [-2]	1.35 [4]	0.91 [-1]	1.01 [0]
<b>Asian</b>	2.6	62.4	1.12 [0]	1.04 [0]	1.03 [0]	0.92 [0]	1.10 [0]	1.16 [0]	0.76 [-1]	0.82 [0]
<b>Indigenous</b>	3.3	60.7	1.09 [0]	0.95 [0]	0.90 [0]	0.96 [0]	0.71 [-1]	1.11 [0]	0.84 [-1]	1.14 [0]

**Appendix Table 5.** Results on Quality, Equality and Equity for Pará. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>40.0</b>	<b>45.0</b>	<b>89.6</b>	<b>8.5</b>	<b>6.8</b>	<b>19.6</b>	<b>4.8</b>
<b>Effect RR[PAR]</b>				0.98 [-1]	0.97 [-1]	0.99 [-1]	0.92 [-1]	0.93 [0]	0.97 [-1]	0.97 [0]
<b>Low Parental Education</b>	61.6	68.3	1.17 [10]	1.02 [1]	0.91 [-6]	1.00 [0]	0.74 [-19]	0.82 [-12]	0.92 [-5]	0.81 [-13]
<b>Poverty</b>	41.7	66.8	1.03 [1]	1.00 [0]	0.87 [-6]	1.00 [0]	0.77 [-10]	0.90 [-4]	0.87 [-6]	0.80 [-9]
<b>White</b>	23.9	68.6	1.06 [1]	0.98 [0]	1.01 [0]	0.99 [0]	1.03 [1]	0.99 [0]	1.04 [1]	1.04 [1]
<b>Brown</b>	56.5	63.3	0.92 [-5]	1.01 [0]	0.96 [-2]	1.01 [0]	1.00 [0]	1.00 [0]	0.95 [-3]	0.94 [-4]
<b>Black</b>	12.3	72.6	1.12 [1]	1.01 [0]	1.04 [1]	0.99 [0]	0.95 [-1]	0.98 [0]	1.00 [0]	1.06 [1]
<b>Asian</b>	3.1	70.4	1.07 [0]	1.04 [0]	0.98 [0]	0.99 [0]	0.95 [0]	1.02 [0]	1.09 [0]	1.12 [0]
<b>Indigenous</b>	4.1	60.2	0.91 [0]	0.96 [0]	1.07 [0]	1.01 [0]	1.07 [0]	1.08 [0]	1.05 [0]	0.95 [0]

**Appendix Table 6.** Results on Quality, Equality and Equity for Amapá. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>48.4</b>	<b>83.0</b>	<b>76.3</b>	<b>13.8</b>	<b>5.1</b>	<b>11.9</b>	<b>4.4</b>
<b>Effect RR[PAR]</b>				1.00 [0]	0.94 [-5]	0.99 [-1]	0.99 [0]	1.08 [0]	1.03 [0]	0.95 [0]
<b>Low Parental Education</b>	49.8	72.0	1.2 [9]	0.88 [-7]	0.94 [-3]	1.00 [0]	0.99 [0]	1.19 [9]	1.28 [12]	1.00 [0]
<b>Poverty</b>	25.0	67.8	1.02 [1]	0.89 [-3]	0.92 [-2]	1.04 [1]	0.85 [-4]	1.40 [9]	1.02 [1]	0.95 [-1]
<b>White</b>	28.0	69.8	1.07 [2]	1.04 [1]	1.00 [0]	1.06 [2]	1.17 [5]	0.85 [-4]	0.96 [-1]	1.31 [8]
<b>Brown</b>	49.1	62.4	0.88 [-6]	0.97 [-2]	0.98 [-1]	0.96 [-2]	0.88 [-6]	0.96 [-2]	1.11 [5]	1.01 [0]
<b>Black</b>	15.2	75.7	1.16 [2]	0.97 [0]	1.01 [0]	1.00 [0]	0.98 [0]	1.25 [4]	0.89 [-2]	0.80 [-3]
<b>Asian</b>	3.3	73.2	1.10 [0]	0.90 [0]	1.02 [0]	0.96 [0]	0.89 [0]	1.19 [1]	0.84 [-1]	0.56 [-1]
<b>Indigenous</b>	4.5	58.4	0.87 [-1]	1.14 [1]	1.07 [0]	0.99 [0]	1.12 [1]	1.13 [1]	1.04 [0]	0.56 [-2]

**Appendix Table 7.** Results on Quality, Equality and Equity for Tocantins. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>32.9</b>	<b>54.7</b>	<b>95.3</b>	<b>23.1</b>	<b>12.6</b>	<b>56.4</b>	<b>11.0</b>
<b>Effect RR[PAR]</b>				0.99 [0]	0.89 [-6]	0.98 [-2]	0.89 [-3]	0.88 [-2]	0.92 [-5]	0.89 [-1]
<b>Low Parental Education</b>	53.6	67.3	1.39 [17]	0.99 [-1]	0.89 [-6]	1.00 [0]	0.76 [-15]	0.84 [-10]	0.87 [-7]	0.92 [-5]
<b>Poverty</b>	47.6	64.7	1.15 [7]	0.97 [-1]	0.89 [-6]	0.98 [-1]	0.76 [-13]	0.80 [-11]	0.88 [-6]	0.81 [-10]
<b>White</b>	24.8	60.6	1.01 [0]	0.96 [-1]	1.01 [0]	1.01 [0]	1.07 [2]	1.15 [4]	1.05 [1]	1.08 [2]
<b>Brown</b>	56.6	57.8	0.91 [-5]	1.06 [3]	1.02 [1]	0.99 [-1]	1.00 [0]	0.93 [-4]	0.97 [-2]	0.93 [-4]
<b>Black</b>	11.8	70.7	1.20 [2]	0.98 [0]	0.96 [-1]	1.01 [0]	0.93 [-1]	0.92 [-1]	0.98 [0]	0.96 [0]
<b>Asian</b>	3.5	63.1	1.05 [0]	0.98 [0]	1.03 [0]	1.00 [0]	0.96 [0]	0.97 [0]	1.03 [0]	1.08 [0]
<b>Indigenous</b>	3.4	58.4	0.97 [0]	0.92 [0]	0.94 [0]	1.00 [0]	0.86 [0]	1.04 [0]	1.00 [0]	1.16 [1]

**Appendix Table 8.** Results on Quality, Equality and Equity for Maranhão. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>26.6</b>	<b>7.4</b>	<b>87.8</b>	<b>5.0</b>	<b>7.9</b>	<b>13.7</b>	<b>10.2</b>
<b>Effect RR[PAR]</b>				0.95 [-1]	0.90 [-1]	0.98 [-2]	0.92 [0]	0.89 [-1]	0.95 [-1]	0.93 [-1]
<b>Low Parental Education</b>	66.1	73.2	1.26 [15]	0.87 [-10]	0.69 [-26]	1.01 [0]	0.81 [-15]	0.72 [-23]	0.84 [-12]	0.78 [-17]
<b>Poverty</b>	55.2	70.9	1.07 [4]	0.87 [-8]	0.69 [-20]	1.00 [0]	0.71 [-19]	0.75 [-16]	0.83 [-10]	0.77 [-14]
<b>White</b>	24.5	71.8	1.06 [1]	0.98 [0]	0.96 [-1]	1.01 [0]	1.01 [0]	0.98 [0]	0.97 [-1]	0.94 [-1]
<b>Brown</b>	53.6	65.8	0.91 [-5]	0.98 [-1]	1.00 [0]	1.00 [0]	0.94 [-4]	0.96 [-2]	0.98 [-1]	0.97 [-2]
<b>Black</b>	13.9	76.3	1.13 [2]	1.04 [1]	1.02 [0]	0.98 [0]	1.02 [0]	1.01 [0]	1.06 [1]	1.04 [1]
<b>Asian</b>	4.2	73.6	1.07 [0]	1.03 [0]	0.92 [0]	0.98 [0]	1.09 [0]	1.03 [0]	0.99 [0]	1.16 [1]
<b>Indigenous</b>	3.8	62.5	0.90 [0]	1.08 [0]	1.24 [1]	0.99 [0]	1.24 [1]	1.26 [1]	1.09 [0]	1.17 [1]

**Appendix Table 9.** Results on Quality, Equality and Equity for Piauí. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>31.3</b>	<b>31.8</b>	<b>87.4</b>	<b>11.1</b>	<b>9.2</b>	<b>15.5</b>	<b>6.9</b>
<b>Effect RR[PAR]</b>				0.94 [-2]	0.90 [-3]	0.98 [-2]	0.94 [-1]	0.86 [-1]	0.92 [-1]	0.95 [0]
<b>Low Parental Education</b>	69.7	66.9	1.17 [11]	0.89 [-9]	0.84 [-13]	1.00 [0]	0.78 [-18]	0.74 [-22]	0.92 [-6]	0.94 [-5]
<b>Poverty</b>	55.0	66.3	1.06 [3]	0.82 [-11]	0.81 [-12]	1.00 [0]	0.80 [-12]	0.69 [-20]	0.86 [-8]	0.74 [-17]
<b>White</b>	24.2	66.1	1.03 [1]	1.01 [0]	0.90 [-2]	1.00 [0]	0.99 [0]	1.00 [0]	0.92 [-2]	0.89 [-3]
<b>Brown</b>	52.5	61.8	0.91 [-5]	0.93 [-4]	1.01 [1]	1.00 [0]	0.97 [-2]	0.88 [-7]	1.02 [1]	0.90 [-6]
<b>Black</b>	14.1	73.0	1.16 [2]	1.05 [1]	1.04 [1]	1.00 [0]	1.00 [0]	1.08 [1]	0.99 [0]	1.08 [1]
<b>Asian</b>	4.7	67.2	1.04 [0]	1.06 [0]	1.13 [1]	1.00 [0]	1.14 [1]	1.27 [1]	1.12 [1]	1.44 [2]
<b>Indigenous</b>	4.6	59.0	0.91 [0]	1.19 [1]	1.08 [0]	1.03 [0]	1.05 [0]	1.27 [1]	1.11 [1]	1.40 [2]

**Appendix Table 10.** Results on Quality, Equality and Equity for Ceará. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>55.1</b>	<b>29.7</b>	<b>91.1</b>	<b>13.0</b>	<b>13.7</b>	<b>33.8</b>	<b>12.2</b>
<b>Effect RR[PAR]</b>				0.98 [-1]	0.91 [-3]	1.00 [0]	0.88 [-2]	0.95 [-1]	0.94 [-2]	0.94 [-1]
<b>Low Parental Education</b>	68.8	68.3	1.19 [12]	0.95 [-4]	0.80 [-16]	1.01 [1]	0.79 [-17]	0.90 [-7]	0.95 [-4]	0.84 [-12]
<b>Poverty</b>	58.9	67.4	1.04 [2]	0.95 [-3]	0.80 [-14]	1.00 [0]	0.73 [-19]	0.98 [-1]	0.95 [-3]	0.82 [-12]
<b>White</b>	26.1	68.4	1.04 [1]	0.97 [-1]	0.91 [-2]	1.00 [0]	0.90 [-3]	0.95 [-1]	0.97 [-1]	1.01 [0]
<b>Brown</b>	55.8	63.3	0.90 [-6]	1.03 [2]	1.06 [3]	1.00 [0]	1.05 [3]	1.03 [2]	0.98 [-1]	0.95 [-3]
<b>Black</b>	10.2	77.0	1.18 [2]	0.98 [0]	0.99 [0]	1.00 [0]	0.97 [0]	1.01 [0]	1.06 [1]	1.05 [1]
<b>Asian</b>	4.1	70.5	1.07 [0]	0.99 [0]	0.93 [0]	1.00 [0]	1.06 [0]	1.02 [0]	1.04 [0]	1.06 [0]
<b>Indigenous</b>	3.8	61.9	0.93 [0]	1.01 [0]	1.21 [1]	0.99 [0]	1.17 [1]	1.00 [0]	1.10 [0]	1.13 [1]



**Appendix Table 11.** Results on Quality, Equality and Equity for Rio Grande do Norte. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>65.9</b>	<b>27.5</b>	<b>86.0</b>	<b>14.0</b>	<b>12.5</b>	<b>18.3</b>	<b>3.8</b>
<b>Effect RR[PAR]</b>				0.99 [-1]	0.98 [-1]	1.01 [1]	0.97 [0]	0.95 [-1]	0.99 [0]	0.96 [0]
<b>Low Parental Education</b>	68.3	77.0	1.18 [11]	1.01 [1]	0.84 [-12]	0.99 [-1]	0.89 [-8]	0.90 [-8]	0.99 [-1]	0.80 [-16]
<b>Poverty</b>	47.1	75.6	1.03 [2]	0.99 [0]	0.82 [-9]	1.00 [0]	0.89 [-6]	0.85 [-7]	0.99 [0]	0.86 [-7]
<b>White</b>	32.5	74.8	1.01 [0]	1.00 [0]	0.99 [0]	1.00 [0]	1.12 [4]	0.96 [-1]	1.00 [0]	1.04 [1]
<b>Brown</b>	45.7	72.5	0.95 [-2]	1.01 [0]	0.99 [0]	1.01 [0]	0.89 [-5]	0.93 [-4]	1.04 [2]	1.01 [1]
<b>Black</b>	13.5	81.1	1.11 [1]	0.99 [0]	1.01 [0]	0.99 [0]	1.02 [0]	1.16 [2]	0.95 [-1]	0.90 [-1]
<b>Asian</b>	4.5	74.4	1.00 [0]	1.00 [0]	1.04 [0]	1.01 [0]	1.05 [0]	1.17 [1]	1.03 [0]	0.79 [-1]
<b>Indigenous</b>	3.8	68.6	0.92 [0]	1.00 [0]	1.02 [0]	0.99 [0]	0.95 [0]	1.09 [0]	0.85 [-1]	1.23 [1]

**Appendix Table 12.** Results on Quality, Equality and Equity for Paraíba. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>49.7</b>	<b>10.6</b>	<b>89.1</b>	<b>10.0</b>	<b>10.3</b>	<b>18.8</b>	<b>6.8</b>
<b>Effect RR[PAR]</b>				0.99 [-1]	0.92 [-1]	0.98 [-1]	0.87 [-1]	0.89 [-1]	0.93 [-1]	0.98 [0]
<b>Low Parental Education</b>	73.5	67.4	1.22 [14]	0.98 [-1]	0.71 [-27]	0.99 [-1]	0.77 [-20]	0.77 [-20]	0.81 [-16]	0.88 [-10]
<b>Poverty</b>	50.9	67.7	1.08 [4]	0.99 [-1]	0.69 [-19]	1.00 [0]	0.77 [-14]	0.76 [-14]	0.79 [-12]	0.93 [-3]
<b>White</b>	31.5	66.1	1.02 [1]	0.98 [-1]	1.05 [1]	1.00 [0]	0.97 [-1]	0.96 [-1]	0.99 [0]	0.95 [-2]
<b>Brown</b>	48.0	62.6	0.92 [-4]	1.01 [0]	0.98 [-1]	1.00 [0]	1.00 [0]	0.97 [-2]	0.93 [-3]	1.07 [3]
<b>Black</b>	11.9	75.4	1.18 [2]	1.00 [0]	0.86 [-2]	0.99 [0]	1.04 [1]	1.01 [0]	1.09 [1]	1.00 [0]
<b>Asian</b>	3.8	67.7	1.04 [0]	1.05 [0]	0.92 [0]	1.00 [0]	1.09 [0]	1.23 [1]	1.17 [1]	1.04 [0]
<b>Indigenous</b>	4.8	59.2	0.90 [0]	1.02 [0]	1.30 [1]	1.01 [0]	0.94 [0]	1.19 [1]	1.10 [0]	0.84 [-1]

**Appendix Table 13.** Results on Quality, Equality and Equity for Pernambuco. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>37.1</b>	<b>18.1</b>	<b>88.4</b>	<b>9.4</b>	<b>8.8</b>	<b>26.0</b>	<b>8.9</b>
<b>Effect RR[PAR]</b>				0.98 [-1]	0.95 [-1]	1.00 [0]	0.96 [0]	0.94 [-1]	0.95 [-1]	0.99 [0]
<b>Low Parental Education</b>	71.6	70.7	1.2 [13]	0.98 [-2]	0.83 [-14]	1.01 [1]	0.91 [-7]	0.90 [-8]	0.88 [-9]	0.90 [-8]
<b>Poverty</b>	49.7	69.3	1.04 [2]	0.94 [-3]	0.85 [-8]	1.01 [0]	0.87 [-7]	0.84 [-9]	0.86 [-7]	0.95 [-3]
<b>White</b>	28.1	68.5	1.01 [0]	0.99 [0]	0.94 [-2]	1.00 [0]	1.06 [2]	1.05 [1]	0.98 [0]	1.03 [1]
<b>Brown</b>	50.8	66.0	0.94 [-3]	1.00 [0]	0.98 [-1]	1.01 [1]	0.96 [-2]	1.02 [1]	0.99 [-1]	1.01 [0]
<b>Black</b>	12.5	75.2	1.12 [2]	1.01 [0]	1.09 [1]	0.99 [0]	0.95 [-1]	0.87 [-2]	1.04 [0]	1.01 [0]
<b>Asian</b>	3.8	75.2	1.11 [0]	0.97 [0]	1.05 [0]	1.01 [0]	1.03 [0]	0.90 [0]	1.06 [0]	0.94 [0]
<b>Indigenous</b>	4.8	61.5	0.90 [0]	1.08 [0]	1.12 [1]	0.97 [0]	1.06 [0]	1.06 [0]	1.01 [0]	0.86 [-1]

**Appendix Table 14.** Results on Quality, Equality and Equity for Alagoas. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>37.2</b>	<b>28.2</b>	<b>86.7</b>	<b>8.3</b>	<b>5.8</b>	<b>15.3</b>	<b>5.7</b>
<b>Effect RR[PAR]</b>				0.99 [0]	0.93 [-2]	1.01 [1]	0.93 [-1]	1.02 [0]	0.96 [-1]	1.01 [0]
<b>Low Parental Education</b>	74.2	74.5	1.17 [11]	0.95 [-4]	0.88 [-10]	0.99 [-1]	0.85 [-12]	1.19 [13]	0.90 [-8]	1.18 [12]
<b>Poverty</b>	51.9	73.4	1.03 [1]	0.96 [-2]	0.81 [-11]	1.01 [0]	0.83 [-9]	1.13 [6]	0.90 [-6]	1.11 [5]
<b>White</b>	24.8	74.3	1.04 [1]	1.02 [0]	0.98 [0]	1.01 [0]	1.12 [3]	1.04 [1]	1.06 [2]	0.94 [-1]
<b>Brown</b>	53.0	70.1	0.93 [-4]	0.97 [-2]	0.96 [-2]	1.00 [0]	0.84 [-9]	0.92 [-4]	0.97 [-1]	1.00 [0]
<b>Black</b>	14.1	78.1	1.09 [1]	1.03 [0]	1.04 [1]	1.00 [0]	1.06 [1]	1.15 [2]	0.94 [-1]	1.05 [1]
<b>Asian</b>	3.9	77.8	1.08 [0]	1.08 [0]	1.10 [0]	0.98 [0]	1.16 [1]	0.99 [0]	1.04 [0]	1.00 [0]
<b>Indigenous</b>	4.2	66.4	0.91 [0]	0.96 [0]	1.14 [1]	0.97 [0]	1.23 [1]	0.89 [0]	1.01 [0]	1.12 [0]

**Appendix Table 15.** Results on Quality, Equality and Equity for Sergipe. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>63.4</b>	<b>53.5</b>	<b>86.3</b>	<b>9.5</b>	<b>9.1</b>	<b>15.5</b>	<b>11.6</b>
<b>Effect RR[PAR]</b>				0.93 [-5]	0.94 [-3]	1.00 [0]	0.97 [0]	0.96 [0]	0.90 [-2]	0.96 [0]
<b>Low Parental Education</b>	70.2	68.5	1.15 [10]	0.92 [-6]	0.90 [-7]	1.01 [0]	0.89 [-9]	0.93 [-5]	0.72 [-24]	0.78 [-18]
<b>Poverty</b>	49.4	67.3	1.03 [2]	0.94 [-3]	0.90 [-5]	1.01 [0]	0.83 [-9]	0.86 [-7]	0.83 [-9]	0.78 [-12]
<b>White</b>	23.5	68.5	1.05 [1]	0.98 [-1]	1.01 [0]	1.00 [0]	1.13 [3]	0.82 [-4]	0.91 [-2]	1.04 [1]
<b>Brown</b>	53.0	63.7	0.92 [-4]	1.03 [1]	0.99 [-1]	1.02 [1]	0.93 [-4]	1.08 [4]	1.01 [1]	0.91 [-5]
<b>Black</b>	14.1	72.5	1.11 [2]	0.98 [0]	1.00 [0]	0.98 [0]	1.06 [1]	1.11 [2]	1.15 [2]	1.04 [1]
<b>Asian</b>	3.5	71.1	1.08 [0]	0.98 [0]	1.05 [0]	1.00 [0]	0.84 [-1]	0.89 [0]	1.00 [0]	1.05 [0]
<b>Indigenous</b>	5.9	61.9	0.93 [0]	1.01 [0]	0.99 [0]	0.97 [0]	0.87 [-1]	1.08 [0]	0.92 [0]	1.18 [1]

**Appendix Table 16.** Results on Quality, Equality and Equity for Bahia. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>36.4</b>	<b>35.2</b>	<b>88.8</b>	<b>7.9</b>	<b>6.6</b>	<b>15.0</b>	<b>12.7</b>
<b>Effect RR[PAR]</b>				0.93 [-3]	0.92 [-3]	0.99 [-1]	0.94 [0]	0.95 [0]	0.93 [-1]	0.96 [0]
<b>Low Parental Education</b>	66.3	67.8	1.22 [13]	0.90 [-7]	0.80 [-16]	1.00 [0]	0.85 [-11]	0.92 [-5]	0.82 [-14]	0.86 [-10]
<b>Poverty</b>	47.8	65.6	1.04 [2]	0.92 [-4]	0.84 [-8]	1.00 [0]	0.83 [-9]	0.93 [-3]	0.86 [-7]	0.88 [-6]
<b>White</b>	20.4	67.9	1.07 [1]	0.89 [-2]	0.84 [-3]	1.00 [0]	0.89 [-2]	0.97 [-1]	0.83 [-4]	0.94 [-1]
<b>Brown</b>	47.7	61.4	0.92 [-4]	0.95 [-2]	0.93 [-3]	1.00 [0]	1.01 [1]	0.96 [-2]	0.95 [-3]	0.96 [-2]
<b>Black</b>	22.2	67.8	1.07 [2]	1.14 [3]	1.23 [5]	1.00 [0]	1.00 [0]	1.00 [0]	1.18 [4]	1.04 [1]
<b>Asian</b>	3.5	69.2	1.08 [0]	1.04 [0]	1.05 [0]	0.99 [0]	1.07 [0]	1.04 [0]	1.06 [0]	1.09 [0]
<b>Indigenous</b>	6.1	59.0	0.91 [-1]	1.10 [1]	1.10 [1]	0.98 [0]	1.24 [1]	1.25 [1]	1.17 [1]	1.18 [1]

**Appendix Table 17.** Results on Quality, Equality and Equity for Minas Gerais. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>33.0</b>	<b>39.4</b>	<b>94.5</b>	<b>22.8</b>	<b>15.0</b>	<b>40.5</b>	<b>11.8</b>
<b>Effect RR[PAR]</b>				0.88 [-4]	0.81 [-8]	0.95 [-5]	0.81 [-4]	0.95 [-1]	0.91 [-4]	0.91 [-1]
<b>Low Parental Education</b>	60.8	45.4	1.59 [26]	0.88 [-8]	0.88 [-8]	1.00 [0]	0.73 [-20]	0.90 [-6]	0.87 [-9]	0.77 [-16]
<b>Poverty</b>	27.3	50.4	1.32 [8]	0.80 [-6]	0.83 [-5]	1.00 [0]	0.67 [-10]	0.93 [-2]	0.83 [-5]	0.69 [-9]
<b>White</b>	30.4	36.8	0.85 [-5]	1.15 [4]	1.09 [3]	1.00 [0]	1.12 [4]	0.96 [-1]	1.07 [2]	0.98 [-1]
<b>Brown</b>	52.2	41.4	1.00 [0]	0.89 [-6]	0.96 [-2]	1.00 [0]	0.92 [-5]	1.03 [1]	0.95 [-3]	0.96 [-2]
<b>Black</b>	10.3	54.3	1.36 [4]	0.98 [0]	0.92 [-1]	0.99 [0]	0.94 [-1]	1.00 [0]	0.99 [0]	1.03 [0]
<b>Asian</b>	2.9	50.2	1.22 [1]	0.98 [0]	0.94 [0]	1.00 [0]	1.01 [0]	1.04 [0]	1.00 [0]	1.14 [0]
<b>Indigenous</b>	4.2	38.3	0.92 [0]	0.99 [0]	0.99 [0]	0.99 [0]	1.05 [0]	1.03 [0]	0.98 [0]	1.17 [1]

**Appendix Table 18.** Results on Quality, Equality and Equity for Espírito Santo. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>55.7</b>	<b>50.1</b>	<b>85.5</b>	<b>31.4</b>	<b>22.0</b>	<b>43.5</b>	<b>11.2</b>
<b>Effect RR[PAR]</b>				0.98 [-1]	0.90 [-5]	0.95 [-4]	0.93 [-2]	0.93 [-2]	0.96 [-2]	0.96 [0]
<b>Low Parental Education</b>	62.3	51.3	1.38 [19]	0.97 [-2]	0.90 [-7]	0.99 [0]	0.93 [-4]	0.97 [-2]	0.96 [-2]	0.81 [-13]
<b>Poverty</b>	26.7	51.5	1.14 [4]	1.00 [0]	0.91 [-2]	1.00 [0]	0.89 [-3]	0.90 [-3]	0.93 [-2]	0.86 [-4]
<b>White</b>	25.3	43.4	0.90 [-3]	0.98 [0]	1.00 [0]	1.01 [0]	1.01 [0]	1.02 [0]	1.07 [2]	0.97 [-1]
<b>Brown</b>	55.5	46.0	0.96 [-2]	1.02 [1]	1.01 [0]	1.00 [0]	0.99 [0]	1.02 [1]	0.95 [-3]	1.03 [2]
<b>Black</b>	11.3	59.4	1.31 [3]	0.99 [0]	1.00 [0]	0.98 [0]	1.03 [0]	0.94 [-1]	1.01 [0]	0.99 [0]
<b>Asian</b>	2.8	54.6	1.17 [0]	1.03 [0]	0.92 [0]	0.98 [0]	0.95 [0]	1.02 [0]	0.97 [0]	0.91 [0]
<b>Indigenous</b>	5.1	42.1	0.89 [-1]	0.98 [0]	1.01 [0]	1.00 [0]	0.95 [0]	0.94 [0]	1.03 [0]	1.05 [0]



**Appendix Table 19.** Results on Quality, Equality and Equity for Rio de Janeiro. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>23.8</b>	<b>69.3</b>	<b>88.0</b>	<b>28.0</b>	<b>20.0</b>	<b>40.4</b>	<b>11.9</b>
<b>Effect RR[PAR]</b>				0.95 [-1]	0.98 [-1]	0.94 [-5]	0.97 [-1]	0.95 [-1]	0.97 [-1]	0.95 [-1]
<b>Low Parental Education</b>	57.7	51.9	1.27 [13]	0.98 [-1]	0.97 [-2]	1.00 [0]	0.91 [-6]	0.90 [-6]	0.96 [-2]	0.92 [-5]
<b>Poverty</b>	21.4	52.5	1.11 [2]	0.95 [-1]	0.98 [0]	1.00 [0]	0.91 [-2]	0.89 [-2]	0.97 [-1]	0.92 [-2]
<b>White</b>	28.3	44.2	0.88 [-3]	1.03 [1]	0.99 [0]	1.00 [0]	1.03 [1]	1.04 [1]	1.00 [0]	1.08 [2]
<b>Brown</b>	45.3	47.6	0.97 [-1]	1.00 [0]	1.01 [0]	1.01 [0]	1.00 [0]	0.99 [-1]	1.02 [1]	0.95 [-2]
<b>Black</b>	18.1	57.4	1.24 [4]	0.95 [-1]	1.01 [0]	0.99 [0]	0.97 [-1]	0.98 [0]	0.99 [0]	1.00 [0]
<b>Asian</b>	3.6	54.0	1.12 [0]	0.99 [0]	1.02 [0]	0.99 [0]	0.97 [0]	0.99 [0]	0.94 [0]	0.96 [0]
<b>Indigenous</b>	4.7	43.3	0.89 [-1]	1.00 [0]	0.98 [0]	0.99 [0]	0.96 [0]	0.95 [0]	0.96 [0]	0.96 [0]

**Appendix Table 20.** Results on Quality, Equality and Equity for São Paulo. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>54.3</b>	<b>89.6</b>	<b>90.4</b>	<b>32.9</b>	<b>23.5</b>	<b>47.6</b>	<b>26.2</b>
<b>Effect RR[PAR]</b>				0.99 [0]	0.97 [-3]	0.94 [-5]	0.92 [-3]	0.90 [-2]	0.92 [-4]	0.95 [-1]
<b>Low Parental Education</b>	54.1	48.7	1.41 [18]	0.99 [0]	0.98 [-1]	0.99 [0]	0.95 [-3]	0.98 [-1]	0.96 [-2]	0.95 [-3]
<b>Poverty</b>	18.4	51.8	1.21 [4]	0.97 [0]	0.98 [0]	1.00 [0]	0.94 [-1]	0.96 [-1]	0.96 [-1]	0.93 [-1]
<b>White</b>	40.3	40.0	0.84 [-7]	1.00 [0]	1.00 [0]	1.01 [0]	1.07 [3]	1.05 [2]	1.03 [1]	1.03 [1]
<b>Brown</b>	44.5	44.3	1.00 [0]	0.99 [0]	1.00 [0]	1.00 [0]	0.96 [-2]	0.97 [-1]	0.99 [-1]	0.98 [-1]
<b>Black</b>	9.2	61.1	1.43 [4]	1.01 [0]	1.01 [0]	0.99 [0]	0.96 [0]	0.96 [0]	0.96 [0]	0.97 [0]
<b>Asian</b>	2.6	53.2	1.21 [1]	1.00 [0]	1.01 [0]	0.99 [0]	0.96 [0]	0.98 [0]	0.95 [0]	0.96 [0]
<b>Indigenous</b>	3.3	44.8	1.01 [0]	0.99 [0]	1.01 [0]	0.99 [0]	0.98 [0]	0.99 [0]	0.99 [0]	0.99 [0]

**Appendix Table 21.** Results on Quality, Equality and Equity for Paraná. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>34.0</b>	<b>42.3</b>	<b>88.4</b>	<b>29.6</b>	<b>20.0</b>	<b>45.1</b>	<b>15.5</b>
<b>Effect RR[PAR]</b>				1.01 [0]	0.90 [-4]	0.94 [-5]	0.88 [-4]	0.94 [-1]	0.93 [-3]	0.94 [-1]
<b>Low Parental Education</b>	60.0	45.5	1.5 [23]	0.98 [-1]	0.89 [-7]	0.99 [0]	0.87 [-8]	0.93 [-4]	0.95 [-3]	0.82 [-12]
<b>Poverty</b>	18.8	49.0	1.27 [5]	0.94 [-1]	0.84 [-3]	1.00 [0]	0.80 [-4]	0.90 [-2]	0.88 [-2]	0.78 [-4]
<b>White</b>	49.8	37.9	0.88 [-6]	0.98 [-1]	1.04 [2]	1.00 [0]	1.06 [3]	0.99 [0]	1.03 [1]	1.04 [2]
<b>Brown</b>	38.7	41.1	1.03 [1]	1.00 [0]	0.95 [-2]	1.00 [0]	0.95 [-2]	1.01 [1]	0.98 [-1]	0.93 [-3]
<b>Black</b>	6.1	55.2	1.40 [2]	1.03 [0]	1.00 [0]	0.98 [0]	0.97 [0]	1.00 [0]	0.96 [0]	1.07 [0]
<b>Asian</b>	2.8	43.9	1.09 [0]	1.01 [0]	1.03 [0]	1.00 [0]	1.01 [0]	0.95 [0]	0.98 [0]	1.04 [0]
<b>Indigenous</b>	2.6	39.4	0.98 [0]	1.06 [0]	1.03 [0]	0.99 [0]	0.96 [0]	1.02 [0]	1.00 [0]	1.13 [0]

**Appendix Table 22.** Results on Quality, Equality and Equity for Santa Catarina. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>73.6</b>	<b>66.0</b>	<b>83.6</b>	<b>27.3</b>	<b>19.1</b>	<b>54.4</b>	<b>10.2</b>
<b>Effect RR[PAR]</b>				0.98 [-1]	0.90 [-7]	0.96 [-3]	0.89 [-3]	0.91 [-2]	0.90 [-5]	0.97 [0]
<b>Low Parental Education</b>	62.4	49.0	1.51 [24]	0.99 [0]	0.95 [-3]	0.99 [-1]	0.91 [-6]	0.91 [-6]	0.92 [-5]	0.89 [-7]
<b>Poverty</b>	11.1	56.4	1.35 [4]	0.99 [0]	0.96 [0]	0.98 [0]	0.88 [-1]	0.91 [-1]	0.93 [-1]	0.92 [-1]
<b>White</b>	61.7	40.7	0.86 [-10]	1.01 [1]	1.01 [1]	0.99 [-1]	1.04 [3]	1.03 [2]	1.04 [2]	0.95 [-3]
<b>Brown</b>	26.8	44.5	1.04 [1]	1.00 [0]	1.01 [0]	1.00 [0]	0.98 [-1]	0.97 [-1]	0.98 [-1]	1.08 [2]
<b>Black</b>	6.5	60.1	1.43 [3]	0.98 [0]	0.94 [0]	1.02 [0]	0.91 [-1]	0.95 [0]	0.94 [0]	1.00 [0]
<b>Asian</b>	2.7	48.6	1.13 [0]	1.00 [0]	0.95 [0]	1.02 [0]	1.00 [0]	1.03 [0]	0.99 [0]	0.90 [0]
<b>Indigenous</b>	2.4	43.7	1.01 [0]	0.97 [0]	1.03 [0]	1.02 [0]	0.99 [0]	1.02 [0]	0.96 [0]	0.93 [0]

**Appendix Table 23.** Results on Quality, Equality and Equity for Rio Grande do Sul. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>35.1</b>	<b>49.5</b>	<b>86.3</b>	<b>35.2</b>	<b>19.3</b>	<b>52.3</b>	<b>9.4</b>
<b>Effect RR[PAR]</b>				1.02 [1]	1.01 [1]	0.99 [-1]	0.92 [-3]	0.95 [-1]	0.94 [-3]	0.97 [0]
<b>Low Parental Education</b>	58.1	49.3	1.38 [18]	0.98 [-1]	1.02 [1]	1.00 [0]	0.93 [-4]	1.00 [0]	1.00 [0]	0.99 [-1]
<b>Poverty</b>	14.7	55.0	1.29 [4]	1.02 [0]	0.98 [0]	1.00 [0]	0.85 [-2]	0.89 [-2]	0.93 [-1]	0.86 [-2]
<b>White</b>	57.5	41.4	0.85 [-9]	0.98 [-1]	0.94 [-3]	1.01 [0]	1.03 [2]	1.03 [2]	1.03 [2]	1.04 [2]
<b>Brown</b>	25.3	43.8	0.98 [0]	1.00 [0]	1.05 [1]	1.00 [0]	1.01 [0]	0.99 [0]	1.01 [0]	0.98 [-1]
<b>Black</b>	11.7	59.7	1.41 [5]	1.07 [1]	1.03 [0]	0.99 [0]	0.93 [-1]	0.93 [-1]	0.92 [-1]	0.94 [-1]
<b>Asian</b>	2.4	50.4	1.14 [0]	0.96 [0]	1.04 [0]	1.00 [0]	0.94 [0]	1.04 [0]	1.03 [0]	0.99 [0]
<b>Indigenous</b>	3.2	43.9	0.99 [0]	0.98 [0]	1.06 [0]	1.00 [0]	0.99 [0]	0.98 [0]	0.94 [0]	1.07 [0]

**Appendix Table 24.** Results on Quality, Equality and Equity for Mato Grosso do Sul. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>54.7</b>	<b>61.0</b>	<b>87.9</b>	<b>33.9</b>	<b>19.4</b>	<b>36.9</b>	<b>13.7</b>
<b>Effect RR[PAR]</b>				0.99 [-1]	0.90 [-6]	0.91 [-9]	0.91 [-3]	0.93 [-1]	0.83 [-7]	1.02 [0]
<b>Low Parental Education</b>	59.1	53.1	1.38 [18]	1.01 [1]	0.89 [-7]	0.98 [-1]	0.91 [-6]	1.04 [2]	0.90 [-6]	1.05 [3]
<b>Poverty</b>	27.2	53.9	1.17 [4]	1.00 [0]	0.91 [-3]	0.97 [-1]	0.88 [-3]	0.91 [-2]	0.85 [-4]	1.06 [2]
<b>White</b>	36.2	47.7	0.99 [0]	1.00 [0]	1.01 [0]	0.98 [-1]	1.04 [1]	1.01 [0]	1.02 [1]	0.87 [-5]
<b>Brown</b>	49.5	46.6	0.94 [-3]	1.00 [0]	1.01 [1]	1.01 [1]	0.93 [-3]	0.98 [-1]	0.96 [-2]	1.02 [1]
<b>Black</b>	8.8	56.6	1.20 [2]	0.97 [0]	0.95 [0]	1.00 [0]	1.05 [0]	1.00 [0]	1.04 [0]	1.19 [2]
<b>Asian</b>	2.4	51.8	1.08 [0]	0.99 [0]	0.97 [0]	1.02 [0]	1.04 [0]	1.04 [0]	1.02 [0]	1.31 [1]
<b>Indigenous</b>	3.1	50.7	1.06 [0]	1.06 [0]	1.02 [0]	0.99 [0]	1.12 [0]	1.04 [0]	1.04 [0]	1.11 [0]

**Appendix Table 25.** Results on Quality, Equality and Equity for Mato Grosso. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>63.1</b>	<b>55.5</b>	<b>88.0</b>	<b>21.5</b>	<b>13.5</b>	<b>33.9</b>	<b>8.6</b>
<b>Effect RR[PAR]</b>				0.93 [-4]	0.95 [-3]	1.02 [2]	0.97 [-1]	0.90 [-1]	0.94 [-2]	1.02 [0]
<b>Low Parental Education</b>	62.6	54.5	1.3 [16]	0.95 [-4]	0.95 [-3]	0.99 [-1]	0.93 [-5]	0.89 [-7]	0.91 [-6]	0.97 [-2]
<b>Poverty</b>	30.8	56.3	1.13 [4]	0.95 [-1]	0.91 [-3]	0.99 [0]	0.82 [-6]	0.92 [-2]	0.85 [-5]	0.94 [-2]
<b>White</b>	30.5	51.1	0.98 [-1]	1.00 [0]	0.99 [0]	1.00 [0]	0.96 [-1]	1.17 [5]	1.01 [0]	0.92 [-2]
<b>Brown</b>	50.9	49.5	0.91 [-5]	1.02 [1]	1.02 [1]	1.01 [0]	1.05 [2]	0.94 [-3]	1.00 [0]	1.13 [6]
<b>Black</b>	12.2	62.2	1.23 [3]	0.98 [0]	0.99 [0]	0.99 [0]	0.98 [0]	0.84 [-2]	0.98 [0]	0.95 [-1]
<b>Asian</b>	3.1	58.9	1.14 [0]	0.94 [0]	0.94 [0]	1.00 [0]	1.08 [0]	0.95 [0]	0.97 [0]	0.74 [-1]
<b>Indigenous</b>	3.2	52.0	1.00 [0]	0.98 [0]	0.96 [0]	0.99 [0]	0.92 [0]	1.03 [0]	1.01 [0]	1.00 [0]

**Appendix Table 26.** Results on Quality, Equality and Equity for Goiás. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>57.3</b>	<b>39.6</b>	<b>90.5</b>	<b>21.6</b>	<b>14.3</b>	<b>26.2</b>	<b>16.5</b>
<b>Effect RR[PAR]</b>				0.99 [0]	0.97 [-1]	0.96 [-4]	0.97 [-1]	0.96 [-1]	0.97 [-1]	0.97 [0]
<b>Low Parental Education</b>	62.6	56.2	1.22 [12]	1.00 [0]	0.93 [-5]	1.00 [0]	0.89 [-7]	0.90 [-7]	0.90 [-7]	0.91 [-6]
<b>Poverty</b>	32.1	54.6	1.02 [1]	1.02 [1]	0.92 [-3]	1.01 [0]	0.84 [-5]	0.90 [-3]	0.91 [-3]	0.90 [-3]
<b>White</b>	29.7	54.1	1.01 [0]	0.97 [-1]	1.00 [0]	1.00 [0]	1.01 [0]	1.00 [0]	1.07 [2]	1.02 [1]
<b>Brown</b>	53.0	51.3	0.91 [-5]	1.02 [1]	0.99 [-1]	1.00 [0]	0.98 [-1]	0.98 [-1]	0.96 [-2]	1.01 [1]
<b>Black</b>	9.6	64.1	1.22 [2]	0.99 [0]	1.03 [0]	0.99 [0]	0.98 [0]	1.05 [0]	0.95 [0]	0.96 [0]
<b>Asian</b>	3.5	59.1	1.10 [0]	1.03 [0]	1.02 [0]	1.00 [0]	1.03 [0]	1.03 [0]	0.94 [0]	0.92 [0]
<b>Indigenous</b>	4.1	53.6	1.00 [0]	0.99 [0]	1.00 [0]	0.98 [0]	1.08 [0]	1.03 [0]	1.05 [0]	0.96 [0]



**Appendix Table 27.** Results on Quality, Equality and Equity for Distrito Federal. **Data Source:** Prova Brasil, 2007.

	Sub-Population (%)	Low Reading Scores (%)	Equality RR[PAR]	Equity RR [Par]						
				High Teachers' Level of Education	High Teachers' Salary	Teachers Feel Supported	High Level of ICT	Strong Physical Infrastructure	Well-Equipped Library	Safe School
<b>Resource (%)</b>				<b>57.2</b>	<b>99.6</b>	<b>78.2</b>	<b>12.9</b>	<b>3.6</b>	<b>18.8</b>	<b>12.3</b>
<b>Effect RR[PAR]</b>				0.94 [-3]	0.67 [-49]	0.99 [-1]	0.96 [-1]	0.93 [0]	0.96 [-1]	1.11 [1]
<b>Low Parental Education</b>	47.9	35.7	1.35 [15]	0.94 [-3]	1.00 [0]	1.01 [1]	0.73 [-15]	0.95 [-2]	0.82 [-9]	1.10 [5]
<b>Poverty</b>	20.0	35.6	1.14 [3]	0.94 [-1]	1.00 [0]	1.01 [0]	0.77 [-5]	0.86 [-3]	0.93 [-1]	0.98 [0]
<b>White</b>	23.1	30.4	0.93 [-2]	1.02 [0]	1.00 [0]	1.00 [0]	1.18 [4]	1.12 [3]	1.00 [0]	0.98 [0]
<b>Brown</b>	60.3	31.7	0.97 [-2]	0.98 [-1]	1.00 [0]	1.00 [0]	0.88 [-8]	0.94 [-4]	0.99 [-1]	0.99 [0]
<b>Black</b>	8.9	39.9	1.27 [2]	1.00 [0]	1.00 [0]	1.00 [0]	0.97 [0]	0.84 [-1]	0.96 [0]	0.88 [-1]
<b>Asian</b>	2.8	35.8	1.12 [0]	1.05 [0]	1.00 [0]	1.00 [0]	0.95 [0]	1.21 [1]	1.10 [0]	1.02 [0]
<b>Indigenous</b>	4.9	28.8	0.89 [-1]	1.00 [0]	1.00 [0]	0.97 [0]	1.05 [0]	1.00 [0]	1.06 [0]	1.30 [1]