Using PIRLS 2006 to Measure Equity in Reading Achievement Internationally

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BOSTON COLLEGE
Lynch School of Education

Department of
Educational Research, Measurement, and Evaluation

USING PIRLS 2006 TO MEASURE EQUITY IN
READING ACHIEVEMENT INTERNATIONALLY

Dissertation
by
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submitted in partial fulfillment
of the requirements for the degree of
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Abstract

Using PIRLS 2006 to Measure Equity in Reading Achievement Internationally

Dissertation by Kathleen L. Trong
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Equity in educational outcomes, particularly reading, is an important policy issue in countries around the world. This dissertation used data from PIRLS 2006 to explore an approach to measuring equity in reading achievement internationally at the fourth grade. Relative risk ratios were selected as a measurement approach and were used to create a composite measure, the Relative Risk-Percentage (RRP) Equity Index, to compare equity in reading achievement across countries. This index was used to present the likelihood of scoring below the PIRLS 2006 Low International Benchmark for student groups that were traditionally at risk for low reading achievement compared to other students. The ‘at risk’ student groups that were the focus of this study included those with low parental education, who spoke a language other than the language of instruction, who attended urban or rural schools, and who were boys. To complement the RRP Equity Index results, the relative likelihood of students scoring within the lower 20 percent of their country’s reading achievement distribution was also presented. The results of these analyses showed that students with these characteristics were more likely than other fourth grade students to have low reading achievement in a number of the PIRLS 2006 countries. Overall, having parents with less than secondary education and not speaking the language of the test before starting school were associated with inequity in reading achievement in
the largest number of PIRLS 2006 countries. As an example of how individual countries could further explore potential reasons for inequities in reading achievement highlighted by the RRP Equity Index, logistic regression models were built for Germany, Iran, and Romania. These models explored the extent to which statistically controlling for differences in resources could diminish the effect of being in an ‘at risk’ group on reading achievement. In all three countries examined, resources explained a substantial proportion of the risk for low reading achievement. Though the logistic regression model results were country-specific, lacking books in the home was strongly associated with lower reading achievement in all three countries.
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Chapter 1

Introduction

Inequities in educational resources and outcomes exist, to some degree, in every country around the world. If not addressed, these inequities can exacerbate disparities between social groups, impacting life situations ranging from health to the labor market. As the amount and quality of data on educational inputs and outputs continues to grow, there are increasing efforts to measure equity in education and monitor progress toward equity goals.

This dissertation used data from the 2006 cycle of the International Association for the Evaluation of Educational Achievement’s (IEA’s) Progress in International Reading Literacy Study (PIRLS 2006) to explore an approach to measuring equity in reading achievement across countries, focusing on students with the lowest levels of achievement. Additionally, this study investigated the extent to which literacy resources could help explain inequities in reading achievement within a subset of countries that participated in PIRLS 2006. The focus on reading achievement as a basis for a study of inequity was considered particularly appropriate in light of literacy’s integral role as a basic skill that is universally valued in education and critical to further success in school and in life.
Description of Problem

Inequity in Education

Historically, education systems have struggled to address the needs of all citizens in an equitable manner. This problem persists today, with less than 60 percent of adults attaining literacy in many developing countries (World Bank, 2005), and research suggesting that, in some countries, gaps in educational attainment between the most and least advantaged are growing (OECD, 2001).

Even in the world’s wealthiest countries, such as the United States, the historical and present-day achievement gaps between demographic groups are well-documented. Historically, one of the best-known testaments to the achievement disparities among students in the United States from different backgrounds is the Equality of Educational Opportunity Study, better known as the Coleman Report (Coleman, 1966). More than 40 years later, there is evidence that these gaps persist, negatively affecting non-white and economically disadvantaged students (Jencks & Phillips, 1998; Lee, Grigg, & Donahue, 2007). In the United States, the achievement gaps are due in part to variation between schools that often stem from economic differences in the schools’ communities. Students in schools without economic advantages are disproportionately taught by teachers with less training and receive less effective instruction (Darling-Hammond, 1996).

Inequity in education also exists in less developed countries. Efforts to expand access to primary schooling in the 1950s and 60s were successful in many ways. However, this rapid expansion in systems that may not have had adequate resources to
meet the needs of the growing student population often led to increased disparities within educational systems (Cavicchioni & Motivans, 2001).

Achieving equity is becoming increasingly challenging and important as populations shift within and across countries. Internationally, three percent of the world’s population lives in a country other than the one they were born in, a proportion which has doubled since 1970. The majority of the people moving to another country are migrating to the developed countries in North America and Europe, where immigration rates increased by 48 and 16 percent, respectively, from 1990 to 2000 (United Nations, 2002). For example, in the United States it is projected that 60 percent of the population will be Hispanic by 2050, a change that is largely spurred by increased immigration (Day, 2007). Research into this issue in the United States revealed that the combination of immigration trends and the educational attainment of new immigrants could have serious consequences for the United States economy and society. However, it has been argued that if the gaps in educational attainment between Whites and Hispanics were closed, then the public benefits, such as increased tax revenues and reduced social program costs, would be great enough to more than pay for the increased resources required of the education system (Vernez, Crop, & Rydell, 1999).

The growing size of the immigrant population in the United States and its potential impact was discussed in America’s Perfect Storm (Kirsch, Braun, Yamamoto, & Sum, 2007), which examined the interaction of diverging skill distributions, economic changes, and demographic trends. The authors suggest that these three forces, if
unchanged, could result in a less-educated workforce, and that an increasing number of students in the United States will be unqualified for higher-paying jobs. This suggests that, for the United States and other countries, it is critical that the needs of populations that are more ethnically and educationally diverse are addressed.

Literacy is also particularly relevant to the issue of changing population demographics, due to the language barriers that many immigrants and children of immigrants will face in school. A recent review of the literature found that language minority students in the United States are more likely to drop out of school and be placed in lower ability groups than their peers with an English background. However, these students’ literacy skills in English and their native language were positively related to their overall academic success, reinforcing the important role that reading can play for students (Genesee, Lindholm-Leary, Saunders, & Christian, 2005).

**Importance of Education and Literacy**

Inequities related to education and literacy are worth special attention because they are intrinsically related to individual and societal success. Research has found that educational attainment and reading literacy are related to a range of positive outcomes, including increased earnings (Green & Riddell, 2001) and decreased likelihood of unemployment for individuals (OECD, 2000; Lamb, 1997). Negative outcomes associated with a lack of literacy skills include dropping out of high school and dependence on social welfare programs (Berlin & Sum, 1988). At the societal level, countries with greater levels of literacy skills have higher gross domestic products (GDP)
and higher income per capita, and those with less inequality in literacy have less
inequality in the distribution of incomes (OECD & Statistics Canada, 2000). In addition
to economic benefits, research suggests a number of social outcomes are related to
literacy and education, including better health for oneself and one’s family, increased
volunteering, and decreased criminal activity (Wolfe & Haveman, 2001).

**International Movement Toward Equity in Education**

To alleviate the disparities that exist in education, many international
organizations have pushed for increased access to basic education (United Nations
General Assembly, 1989). Most notably, the *Universal Declaration of Human Rights*
(United Nations Department of Public Information, 2007) was ratified in 1948 by the
General Assembly of the United Nations. Article 26 of this declaration explicitly
guaranteed the right to an education for all citizens. In addition, several other articles
address rights that are related to or contingent on education, including an adequate
standard of living with special care for children (Article 25) and participation in the
cultural life of the community (Article 27). More recently, the *Convention on the Rights
of the Child*, guaranteeing every child’s right to education, was ratified as international
law. This is the most widely ratified rights document in the world, differing from the
*Universal Declaration of Human Rights* in that signatories are bound by international law
to uphold the articles (Cavicchioni & Motivans, 2001). Building on this previous work,
the United Nations set a Millennium Development Goal that all children should receive a
While access is an essential first step, the international community has also begun to recognize that the quality of education provided is equally important, particularly as enrollment increases. Arguments for improving quality recognize that the outcomes expected of education are dependent on the nature of the resources provided, and that students are more likely to stay in schools that are of better quality (UNESCO, 2004). This was aptly summarized by Bloom (2004), who wrote that “quality is necessary, because without it school is an empty shell” (p. 34).

A commitment was made to work toward quality education for all students through the World Declaration on Education for All (World Conference on Education for All, 1990) and the subsequent Dakar Framework for Action (World Education Forum, 2000). These documents highlighted the goal of equity and the importance of meeting the needs of vulnerable and disadvantaged children to “improve all aspects of the quality of education and ensure excellence of all...especially in literacy, numeracy, and essential life skills” (World Education Forum, 2000, p. 8). The Dakar Framework for Action provided regional frameworks to guide countries’ work toward education quality, and individual countries have made policy changes that emphasize equity.

Though the Dakar Framework and this movement in general pay particular attention to education in developing countries, wealthier nations are also working toward greater equity. A prominent example is the No Child Left Behind Act in the United States, which placed a national emphasis on the improvement of the quality of education for all types of students. Upon announcing the act, President George W. Bush claimed that the
reforms “…express my deep belief in our public schools and their mission to build the mind and character of every child, from every background, in every part of America” [italics added] (United States Department of Education, 2002). Similar action has also been taken in European countries. The European Union set a series of equity goals to be met by 2010, including a decrease in the proportion of low achieving readers by 20 percent (Commission of the European Countries, 2008).

To ascertain the extent to which these ambitious equity goals are being reached within and across countries, careful and systematic measurement using reliable indicators is essential. Both the European Union and the Organization for Economic Cooperation and Development (OECD) have recently put forth efforts to measure equity. The former created a collection of 29 indicators of equity that focused on various aspects of education (European Group for Research on Equity in Educational Systems, 2005). The latter has produced summaries of national equity practices and strategies in education though a series of country notes and analytical reports. These reports were based on a theoretical framework developed by Levin (2003), which focused on two dimensions of equity. The first of these dimensions emphasized the importance of the distribution of resources and access to education, and the second dimension concerned the success of students, particularly those from traditionally disadvantaged groups. The overarching goal of the OECD country reports was to develop equity policy recommendations using evidence from participating countries based on this framework.
The World Education Forum also recognized the importance of appropriate equity measurement, planning to “monitor progress…at the national, regional, and international levels” (World Education Forum, 2000, p. 9). Building on this, draft guidelines for the Education for All (EFA) Asia and Pacific Mid-Decade Assessment (UNESCO, 2007), intended to help countries develop an approach to analysis of disparities, outlined a series of indicators that countries can use to measure progress in education. Of these, participation in international studies, such as those conducted by the IEA, was listed as a way to ascertain the quality of the education system and make cross-country comparisons. The use of IEA studies was also highlighted as a tool to measure outputs, such as literacy, in evaluating progress toward the United Nation’s Millennium Development goal of primary education for all (Bloom, 2004).

**IEA’s Progress in International Reading Literacy Study (PIRLS)**

This dissertation is based on data from PIRLS 2006. Inaugurated in 2001, PIRLS is an international study of trends in fourth grade student reading achievement that is conducted on a five-year cycle. PIRLS uses nationally representative samples of students to measure reading literacy at the fourth grade, allowing for generalizations at the country level and cross-country comparisons. In addition, PIRLS gathers information about factors that influence reading achievement from students, parents, teachers, schools, and ministries of education. PIRLS 2006 was the second cycle in the PIRLS study, and had 40 participating countries (Mullis, Martin, Kennedy, & Foy, 2007).
Fourth grade students are tested in PIRLS because that is the stage in most educational systems when students should have made the transition from learning to read to reading to learn. Students at this grade are expected to apply basic reading skills to texts and use them to accomplish tasks. PIRLS defines reading literacy as:

the ability to understand and use those written language forms required by society and/or valued by the individual. Young readers can construct meaning from a variety of texts. They read to learn, to participate in communities of readers in school and everyday life, and for enjoyment (Mullis, Kennedy, Martin, & Sainsbury, 2006, p. 3).

This inclusive definition is measured in an ambitious assessment of reading comprehension, including more than six hours of testing time, and an extensive collection of background data.

PIRLS 2006 builds on the experience of the many international studies that IEA has conducted since its founding in the 1960s. As pioneers in international education research, the founders of IEA viewed the world as an educational laboratory, believing that there was much to be learned from international comparative research in education, and this dissertation built from that assertion. The consistently high quality of IEA research makes it a frontrunner in international education research and has led to using IEA data in making policy decisions and reforms in a number of countries (Kellaghan, 1996).
**Purpose of Study**

This dissertation builds on the IEA’s history of measuring student achievement outcomes, with the aim of informing policy. More specifically, the purpose of this dissertation was to provide an approach to measuring equity between student groups in reading achievement internationally, presented in a manner that is useful for policymakers and the general public. In Chapter 4, this research provides countries that participated in PIRLS 2006 an indication of the level of reading achievement equity in their education systems, as well as an approach that can be used to delve deeper into potential reasons for these inequities. It may also provide a model for how future IEA studies can provide information about progress toward equity, furthering IEA’s mission of providing comparative information across countries to improve teaching and learning.

**Defining Equity in Education**

There are many aspects of an education system that could be evaluated in terms of equity, and many ways to define equity for each of those aspects. These range from simple definitions of equality, in which all students receive equal treatment in school regardless of their background (e.g., Jencks, 1988) to complex frameworks that account for the unequal resources that students may have and need at various stages of schooling (e.g., Harvey & Klein, 1989).

For this study, Berne and Stiefel’s (1984) framework of equity was employed. This framework defined equity in three ways: horizontal equity, vertical equity, and equal opportunity. Horizontal equity was defined as equal treatment of equals, so that students
who are alike receive equal resource or outcome shares. Examples of this would include equal expenditures per pupil, equal pupil-teacher ratios, and equal attainment of basic competency levels. In cases when student populations were considered unequal, Berne & Stiefel applied vertical equity. This was defined as the unequal treatment of unequals, recognizing that children are different and should receive treatment based on their differences in appropriate ways. An example of this might be the provision of additional language instruction for students who are non-native speakers of the language used in school. The final principle in Berne and Stiefel’s framework was equal opportunity, defined in a negative way: there should not be differences among students according to characteristics that should not be related to the resource, such as household income or race. In other words, equal opportunity exists when there is a lack of relationship among these characteristics and the variable of interest (e.g., expenditures, outcomes).

While this framework is fairly comprehensive, it inevitably has its limitations and cannot fully capture every aspect of equity in education. In particular, one should note that this framework requires the researcher to make judgments about what constitutes ‘equal’ and ‘unequal’, which is unavoidably value-laden and context-dependent. This presents particular challenges in an international analysis of equity. Recognizing these challenges, this dissertation made an attempt to be as transparent as possible about the choices made in defining and applying equity throughout the research.

For this study, the goal of horizontal equity was emphasized, with vertical equity and equal opportunity viewed as vehicles through which to attain horizontal equity.
Additionally, this research’s primary focus was determining equity in terms of outcomes—namely, reading achievement. Horizontal outcome equity was emphasized because it is the ultimate desired outcome of most educational systems, meaning that all students are able to achieve at least a basic degree of competency. While other forms of equity that focus more on educational inputs are also critical, much of their importance lies in the extent to which they can ultimately help achieve desirable outcomes for all students. Finally, this research focused on equity (or lack thereof) for students with low reading achievement, since those are the students most adversely affected by outcome inequity. In other words, this research focused on the extent to which students from different backgrounds were equally likely to be low achievers in reading, and the inequity in resources that might explain inequities in achievement. For example, are boys more likely to be low achievers in reading than girls at the fourth grade? If this is the case, then what can help explain these differences in outcomes?

This approach to equity measurement is consistent with other work being done in the international arena. The perspective that is being used by the OECD to measure equity in education emphasizes the importance of reducing disparities in terms of the likelihood of particular groups and individuals falling below an unacceptable level, such as an achievement or poverty threshold (Demeuse & Baye, 2008). The OECD framework acknowledges that there has been a “steady shift conceptually in recent decades toward an ‘equality of outcomes’ view (of equity)” (Levin, 2003, p. 8). However, this document also recognized that an equality of outcomes perspective requires that additional resources be provided for those least likely to be successful. Based on this framework and
the research stemming from it, Field, Kuczera, and Pont (2007) made a series of policy recommendations. These included identifying students who are falling behind in school and directing resources to students and regions with the greatest need. Similarly, the European Union’s work to reduce the proportion of students below a set threshold of reading achievement is an example of an emphasis on outcomes for those most in need of assistance (Commission of the European Countries, 2008). The conceptualization of equity used in this dissertation would be applicable to these international policy goals.

**Defining Low Reading Achievement**

This dissertation conceptualized horizontal outcome equity based on an international standard of achievement that made use of the expectations outlined in the *PIRLS 2006 Assessment Framework and Specifications* (Mullis, Kennedy, Martin, & Sainsbury, 2006). This dissertation examined the extent to which different characteristics and resources impact students’ abilities to meet this international standard of achievement, regardless of a country’s performance. This perspective is useful because a primary purpose of international studies, such as PIRLS, is to encourage the development of reading skills in all countries. It is also a perspective that is reflected in other international work being done to measure equity in education (e.g., Demeuse & Baye, 2008). To this end, PIRLS provides international benchmarks, which are descriptions of what skills students demonstrated at particular points along the PIRLS reading achievement scale. The use of the PIRLS benchmarks in this research also links the exploration of equity back to what skills students are exhibiting (or lacking), and the characteristics associated with this differing achievement. Therefore, the PIRLS 2006
Low International Benchmark was used as an international threshold of low achievement for this study.

However, there are some countries in which the majority of students were not able to meet even the lowest international benchmarks, and conversely, those where nearly all students achieved at a high level. In situations where average reading achievement was very high or low, an international standard is not useful if policymakers want to identify those students within their country who are receiving inequitable treatment. Therefore, a national threshold of low reading achievement was also used. For these purposes, low achievement nationally was defined as those students falling at or below the 20th percentile of the country achievement distribution. In addition, because it is important to consider a country’s standing in a global context in addition to within-country equity, equity in achievement between countries was also explored in this dissertation.

**Approaches to Measuring Equity in Education**

In order to examine inequities in reading achievement, a crucial first step was identifying an appropriate way to measure equity in an international context. Therefore, this dissertation explored a number of approaches to measuring equity in education. This review drew primarily from methodologies used in previous research that investigated equity in education and economics (i.e., poverty). These various approaches were then evaluated using a predetermined set of criteria to determine which techniques were most appropriate for the purposes of this dissertation, and the PIRLS data in particular. Based on this evaluation, relative risk ratios were judged to be the methodology best suited for
the present dissertation. This methodology, most often used in epidemiology, was used to present the ‘risk’ of having low achievement associated with a particular student characteristic as compared to students without that characteristic, identifying the degree of outcome inequity for those students. This approach was selected because the level of ‘risk’ can be presented in a concise manner that can be compared across countries and while remaining interpretable for a wide audience. Using these relative risk ratios as a foundation, a composite index of equity in achievement was created and applied to the PIRLS 2006 data. The student characteristics that were examined were selected because of their demonstrated relationship with lower reading achievement in past research, making them ‘risk factors’ for low reading achievement.

The range of situations that exists across countries raises another important aspect of equity research. While it is useful to identify student characteristics that are related to inequity, it is also necessary to explore potential reasons for this inequity in order to begin diminishing it. Logistic regression, in conjunction with relative risk ratios, was chosen as an approach to explore possible reasons for outcome inequities that were found in individual countries. More specifically, the extent to which differences in literacy resources could explain differences in achievement was explored through logistic regression.
Research Questions

The previous pages have briefly outlined the issue of equity in education and its measurement, along with the way that this problem was addressed using PIRLS. More specifically, the following research questions were investigated.

1. Using information from a large-scale international assessment, namely PIRLS 2006, how can issues of equity in education achievement be quantified?

2. In the PIRLS 2006 countries, applying a ‘relative risk’ approach, what is the risk of low reading achievement for fourth grade students associated with the student characteristics of interest?

3. For selected PIRLS 2006 countries, to what extent do differences in resources help explain the increased likelihood of low reading achievement for fourth grade students in an ‘at risk’ group?

Research question 2 was addressed using both the international and national thresholds of low reading achievement, meaning the Low International Benchmark and the 20th percentile in each country. Research question 3 focused only on the national threshold of low reading achievement.

Importance of Study

The value in studying equity in education, particularly in reading, is clear. The previous pages have outlined the benefits that literacy and educational equity can have for individuals and the greater society, and the international community has long recognized the opportunity to learn as a human right. The value that this particular study brought to this endeavor is the use of PIRLS, a comprehensive database that can provide
substantial depth to questions of equity in reading achievement within and across countries.

The PIRLS 2006 data were particularly appropriate for an analysis of equity for several reasons. First and foremost, PIRLS 2006 provided a comprehensive measure of children’s reading literacy, a skill that is central to participation in any society. Given the import of reading in today’s world and the opportunities that it presents, it is perhaps the most appropriate achievement outcome measure that can be used in equity analyses. This was recognized by the United Nations, which made a country’s literacy rate for 15- to 24-year-olds one of the four indicators used to measure progress toward the Millennium Development Goal of universal primary enrollment (Bloom, 2004).

A second asset of the database used in this study was the international comparability of data across countries that it brought to the exploration of equity measurement, and that comparable data were available across 40 countries representing a wide range of economic and cultural diversity. PIRLS is the only existing study that provides such a wealth of comparable reading literacy data at the primary school level, with the potential to conduct research and inform policy in ways that no other database can offer. Concern about the issue of comparability of information across countries was articulated by Puryear (1995), who noted that data gathered on literacy by international organizations is notoriously inconsistent, with countries defining literacy differently or operationalizing a common definition unreliably. He also noted, however, that the IEA was by far the best source of internationally comparable data on education outcomes.
PIRLS (which had not been developed at the time Puryear was writing) resolved Puryear’s concerns with a common definition of reading literacy as well as common measurement with stringent quality standards. Therefore, instead of examining equity issues using datasets unique to individual countries, this research provided the added benefit of cross-country comparisons with high-quality data while simultaneously removing the expense of data collection specifically for this purpose. This can encourage dialogue among decision makers in the international education community and presents an opportunity for countries to learn from one another. The latter point is particularly useful for education systems that may not have policies currently in place that explicitly address equity.

An additional strength of the PIRLS 2006 data was that it utilized student-level measures of home, classroom, and school resources. The ability to use student-level measures, such as those collected in PIRLS, is important to research about indicators of equity. While district- or school-level data can be used to answer many questions of equity, Berne and Stiefel (1995) suggested that many equity studies could provide more accurate conclusions if student-level resource measures were used. In particular, they noted that student-level data that is representative of a larger unit (such as a region or a country) would improve equity studies, which was the case in this endeavor. A related benefit of the PIRLS 2006 data was that it allows for the use of resource indicators (e.g., the number of books in a school) instead of fiscal indicators (e.g., the amount spent on books in a school). The use of resource indicators may provide more accurate reflections of the classroom, home, and school environments than fiscal indicators that are often
used in equity research. Researchers have suggested that the use of expenditures as indicators of equity may be problematic due to variation in pricing, costs, and efficiency. Ruggeiro, Miner, and Blanchard (2002) concluded that nearly half of measured inequity may be due to this variance, and warned against using unadjusted student expenditure measures.

A number of ways to quantify equity were considered in this dissertation in light of the many unique characteristics of the PIRLS 2006 data. Ultimately, relative risk ratios were used to measure equity in reading achievement in relation to a series of student characteristics. Using these ratios as a basis, a composite index was created, the RRP Equity Index. The characteristics that were focused on were being male, attending and urban or rural school, having parents with less than secondary education, and having the language spoken in the home differ from the language of the test. For each of these characteristics, which were chosen because of their demonstrated relation to reading achievement, the RRP Equity Index values and the relative risk of being a low achiever (as compared to students without the characteristic) was calculated for each country. For example, how much more likely were boys to fall below the Low International Benchmark compared to girls? Since most of these characteristics were not mutually exclusive, the risk of having low achievement associated with characteristic combinations that may interact (e.g., being a boy and attending rural school) was also examined. This phase of the analysis provided information about that status of equity in reading achievement in a way that can easily be compared across countries.
Within a subset of PIRLS countries, factors related to the inequitable reading achievement outcomes for ‘at risk’ student groups were explored more thoroughly. This was done using logistic regression models that examined the extent to which differences in resources could be used to explain the high risk of having low achievement for students in ‘at risk’ groups. This phase of the analysis provided a model for how inequities in reading achievement might be further explored within a particular national context.

In summary, this dissertation has the potential to inform policy in the countries that participated in PIRLS 2006, and provide an approach to measure equity in education within and across countries. This research can also contribute to future international studies and their role in education policy and measurement worldwide. In particular, this work will provide a foundation for examining equity issues in PIRLS and TIMSS in 2011.
Chapter 2

Review of the Literature

Introduction

This chapter considers various dimensions of equity in educational opportunities and outcomes, and provides a discussion of the issues involved in equity research in education. The chapter provides a brief historical account of how the goal of achieving equity has influenced education in the United States, followed by discussions of the different ways that equity in education has been defined and the framework that was used in the current study. Methods used to measure equity, and examples of equity measurement within and across education systems are described. The chapter concludes with a description of the importance of literacy as a focus of equity research, background characteristics related to literacy development, and the way that PIRLS conceptualizes reading literacy.

Brief History of the Importance of Educational Equity in the United States

This section provides a short historical chronology of equity movements in education leading up to present-day issues, with particular emphasis on equity concerns in the United States and on recent developments involving how equity is viewed. There has traditionally been a tension between the twin aspirations of equity and excellence in
education policy of the United States. While both are certainly admirable goals, emphasis has historically been placed on one over the other as political and philosophical views of education have fluctuated. In his introduction to *Equality of Educational Opportunity*, Coleman (1974) attributed the beginning of such shifts to the changing role of the child due to the industrial revolution. Prior to industrialization, the child was the responsibility of the family and his or her success directly contributed to the family’s success through his or her role in the activities that sustained the family economically (e.g., farming, craftsmanship). There was little consequence for surrounding families if a child was not successful. This is not to say that education was not valued in these times—an informed population was viewed as the foundation of a successful democracy. In his 1781 *Notes on the State of Virginia*, Thomas Jefferson (1984) summarized this sentiment, saying that

> Every government degenerates when trusted to the rulers of the people alone. The people themselves therefore are its only safe depositories. And to render even them safe their minds must be improved to a certain degree. This indeed is not all that is necessary, though it be essentially necessary. An amendment of our constitution must here come in aid of the public education. (p. 274)

However, as the importance of education grew beyond civic engagement as employment shifted outside of the home, the family unit became less autonomous and parents became less able to prepare their children for their future employment. Children’s preparation for and success in the workplace became a community concern, leading to the beginning of public education in the early 1800s. The limited influence of class structure
in the United States at this time allowed the popularity of public schools to grow quickly, with a focus on equality.

Coleman (1974) outlined four characteristics that formed the foundation of the United States’ education system and its focus on equality. These included the provision of a free basic education, the use of a common curriculum for all students, students from various backgrounds attending the same local school (which was partially due to the dispersed population of the United States), and the emphasis on equality within a local area (due to local funding of schools).

Tesconi and Hurwitz (1974) echoed Coleman’s sentiments, noting that “since its inception, the public school has been thought to be the major instrument through which equality and, more specifically, equality of opportunity would be ensured.” In support of their point of view, they cite Horace Mann’s claim made in 1848 that public education is “beyond all other devices of human origins the greatest equalizer of the conditions of man—the balance wheel of social machinery” (p. 15). The authors asserted that equality of educational opportunity was originally defined as all persons having access to similar instructional resources in public schools, as well as similarities across schools.

It is important to note, however, that the early views described by Coleman and Tesconi and Hurwitz emphasized equality of educational opportunity, thus placing the responsibility to make best use of this opportunity on the child and his or her family. Depending on the economic situation of the family and the contributions that were expected from the child, students from different backgrounds may not have been able to
make full use of the schooling provided at this time. This equality of opportunity also was extended only to White children, with a separate system for African-Americans. As the United States’ population grew and diversified, the early characteristics of equality of opportunity as described by Coleman became increasingly more difficult to maintain.

While the United States has struggled with the best way to reach the goal of equality, the international community also faced such disparities. In 1940, for example, while nearly 80 percent of countries in the Americas and Europe had compulsory primary education, such provisions were not often extended to the inhabitants of their colonies, particularly in Africa, Asia, and the Caribbean (Chabott, 2003). Chabott attributed the acceptance of such inequalities partly to the prominence of eugenics at the time, the study of physical and intellectual differences between groups. This belief in the inherent superiority of some groups undoubtedly shaped the emphasis on quality education for the elite while ignoring others entirely.

However, following the end of the World War II in 1945, attitudes toward human rights for all groups began to shift in the United States and around the world. Internationally, this was exemplified by the ratification of the *Universal Declaration of Human Rights* (United Nations Department of Public Information, 2007) in 1948, in which the General Assembly of the United Nations agreed to the right to education for all people. Similarly, many low-income countries set forth ambitious goals of improving their national education systems at international conferences (Chabott, 2003). However,
there was little realization of the monumental resources it would take to reach these goals, and often little progress was made.

In the United States, the hallmark of this recognition of human rights was the Civil Rights movement that burgeoned in the 1950s and epitomized by the 1954 Supreme Court ruling in *Brown v. Board of Education* that separation by race constitutes inequality of opportunity. *Brown v. Board of Education* marked a pivotal event in the history of education in the United States, primarily for the long overdue recognition of the inequalities faced by African-Americans in education. However, because the ruling was made based on the inequality of the results of segregated schools, it also signified an important shift in the interpretation of equality from an emphasis on inputs to outcomes.

Following this realization, the way that equity was conceptualized changed starkly as the result of James Coleman’s work in the 1960s and 70s. Coleman’s work explored the impact of the lack of equality of educational opportunity among racial and other groups in the United States, as mandated by the Civil Rights Act of 1964. The study led by Coleman (1966), defined equality of opportunity in several ways, with two distinct facets. The first of these defined equality in terms of educational inputs brought to the table by schools and teachers as well as students, whereas the second concentrated on the outputs of the educational process. Applying these definitions to the educational systems of the United States, the authors found gross disparities between schools along racial and regional lines. Differences existed in physical and human resources, as well as achievement outcomes. The achievement gaps between racial groups became more
pronounced as students progressed through school, with non-White students falling further behind.

Jencks (1972) has noted that Coleman’s research began to uncover the fact that, while Brown v. Board of Education was a pivotal shift in law, it had a modest impact on segregation and equality. Jencks provided the example that, in 1965, 90 percent of African-American students in the South were still attending African-American schools (defined as schools in which more than 80 percent of students were African-American), and that this pattern of segregation continued well into the 1960s.

Coleman and his co-authors acknowledged that the dual aspects of educational inputs and outputs do not necessarily work in tandem, and that true equality of opportunity works toward achieving both. Put simply, students from some backgrounds begin school with advantages over others, and society should work to eradicate these differences. However, until these disparities are solved, schools should provide additional resources to the students starting at a disadvantage to help close the pre-existing gaps. This view placed much more responsibility on schools to eradicate student differences, and emphasized outputs as a way in which to measure success. In a subsequent publication, Coleman (1975) stressed that neither inputs or outputs on their own will produce the desired equality, and ultimately concluded that equality of educational opportunity was not a meaningful term because of the vast array of ways that it could be interpreted (and has been since then).
The decades following World War II were a time of social democratic accord in which many disenfranchised groups made substantial gains in the United States. This trend carried into the 1970s, with Title IX of the 1972 Educational Amendments ensuring equal opportunity based on gender in education. In 1979, the United States Department of Education was founded under President Carter. Under the first Secretary of Education, a primary goal was the improvement of equity in education; however, little progress toward this goal was made once President Reagan took office in 1981 (Stallings, 2002).

Beginning in the 1970s and strengthening in the 1980s, market-based initiatives rose to prominence and began to shape the education agenda in the United States and elsewhere. Inherent in this perspective was the importance of individual excellence over equity for the larger community. Apple (1989) argued that in the 1980s the term equality became linked to “individual choice under the conditions of a free market” (p. 9) instead of its previous connection to oppression of disadvantaged groups. The idea of excellence continued to rise in importance during this time period, placing the responsibility for success on the individual. This rise can be partially attributed to the free-market policies of the Reagan administration from 1981-89. During Ronald Reagan’s presidency, federal regulation of education was weakened and emphasis was placed on ability, selectivity, parental choice, and private education as opposed to equity, access, and community schools.

A seminal report by the National Commission on Excellence in Education (1983), titled *A Nation At Risk*, contributed to this emphasis on excellence with claims that
American students were mediocre and lagging behind their peers in other industrialized countries, particularly Japan, in central subjects such as mathematics. These claims resulted in a flurry of state reforms that emphasized accountability and standards. While the report certainly brought the importance of education to the forefront of the national agenda, some felt that equity was sacrificed in the attempt to keep pace with other nations. For example, Strike (as cited in Secada, 1989) summarized the impact of this report as “a triumph of our nation’s economic goals over its political goals, of economic efficiency over democratic participation” (p. 3).

The United States was not alone in noting the spurt of development that came to be known as the ‘East Asian Miracle’. The World Bank (1993) defined this as a movement “achieving high growth with equity” that was observed in a series of Asian countries (Hong Kong, Indonesia, Japan, Malaysia, the Republic of Korea, Singapore, Chinese Taipei, and Thailand) in terms of economic development. Stiglitz (1996) examined the forces behind the rapid growth of these systems, and while there were a series of interacting factors, the governments’ investment in education and human capital played an important role. Many of the policies enacted in Asia during this time actively worked toward equity. For example, Stiglitz wrote that “policies ensuring universal literacy both increased productivity and promoted greater equality” (p. 168). More recent research conducted by Hanushek, Jamison, Jamison, and Woessmann (2008) has found a positive relationship between the cognitive skill level of a country’s population and subsequent economic growth, lending support to the idea of education feeding into economic improvement.
While the policies enacted in one context cannot be directly transplanted to another, the international community was eager to learn from the Asian countries’ success and attempt to replicate it in other developing countries. As a result, greater emphasis was placed on primary education as a vehicle for equitable growth, and development assistance for low-income countries shifted in this direction, as opposed to funds for higher-level training. This movement was manifested at the 1990 Jomtien World Conference on Education for All (Lewin, 2007), where a commitment to a quality education for all children was made. It is interesting to note how starkly these efforts differed from the reaction to Asian development in the United States, where equity fell in importance in favor of a pursuit of individual excellence.

In *Bringing Equity Back*, Petrovich’s (2005) arguments support the idea that the global reaction to Asian development differed from that in the United States. She asserted that the United States educational policies of the 1980s saw a shift away from equity and a fair distribution of resources. Instead, a free-market approach “force(d) schools to improve so they can effectively compete for students” (p. 4), encouraging a ‘survival of the fittest’ mentality. Petrovich suggested that United States educational policies reflected national political and ideological views. She argued that capitalist policies in education such as charter schools, voucher programs, and high-stakes assessments were examples of this encouragement of excellence in schools through competition and a reliance on market forces to improve student learning.
However, proponents of such market-based initiatives have argued that they were implemented as ways to improve education for disadvantaged students. In his 1996 book, *Charter Schools: Creating Hope and Opportunity for American Education*, an early supporter of charter schools, Joe Nathan, summarized his work in such a way. He wrote that his book, and the charter school movement, is for “people who believe, or would like to believe, that schools can help youngsters. All kinds of youngsters. Young people from troubled families. Young people who are angry and alienated…People who believe that schools can make a different in the lives of youngsters,” (p. xiii) suggesting that helping disadvantaged students is a central goal of charter schools.

While it is not possible to draw causal conclusions, the late 1980s also saw a deceleration of racial achievement equity. Minority groups such as Hispanics and African-Americans had been closing the achievement gap in the United States in the 1970s and early 1980s, which analysts associated with the reforms of the previous decades. However, test score improvements for minority students had slowed by 1988 and into the 1990s (Johnston & Viadeoro, 2000; Lee, 2006). O’Day and Smith (1993) evaluated and commented on these shifts in the achievement gaps of the early 1990s. As other authors suggested, they found that gaps were closing in the 1960s through the mid-80s for minority and low-income children, and that this progress was dissipating. Similar to other authors, they attributed decreasing achievement gaps to improvements in social conditions, but they also credited a curricular emphasis on basic skills during this period. At the time O’Day and Smith were writing, they noted that emphasis in the United States was shifting toward higher standards and complex skills, in order to better compete
internationally. The authors urged caution in implementing reforms intended to improve skills, noting that deliberate steps were necessary to ensure that these reforms improved the skills of all students in the United States. They suggested that systemic reforms that emphasized high standards and accountability in school resources, practices, and outcomes would be necessary to improve student achievement in an equitable manner.

President George W. Bush’s No Child Left Behind Act (NCLB) was an attempt to implement such systemic changes at a national level. The act was developed to place a national emphasis on the improvement of the quality of education for all types of students in the United States. Upon announcing the act, President George W. Bush claimed that the reforms “…express my deep belief in our public schools and their mission to build the mind and character of every child, from every background, in every part of America” [italics added] (United States Department of Education, 2002).

The act works toward President Bush’s ambitious goals through increased accountability, requiring states to assess students’ attainment of curriculum standards annually in grades 3-8, and to report school results by subgroups (e.g., race and limited English proficiency). In schools that perform poorly on these tests, low-income students must be provided with supplemental educational services and parents are given the option to move their student to a better school, an example of the use of market-based mechanisms to improve education. Another key component of NCLB is the Reading First Initiative, which provides funding for schools to implement scientifically-based
reading initiatives and assessment tools in early primary school, with particular emphasis on low-income students (United States Department of Education, 2007).

There have been mixed findings regarding changes in student achievement since the implementation of NCLB. Some preliminary research on achievement gap trends since NCLB has suggested that gaps for ethnic minorities, students with disabilities, low-income students, and students with limited proficiency in English are closing, though they remain substantial (Center on Education Policy, 2007). However, analyses using National Assessment of Educational Progress (NAEP) data that addressed similar questions found that achievement had not increased since NCLB and that gaps were not closing (Lee, 2006). Regarding the Reading First Initiative specifically, preliminary evaluation results were not promising. Gamse and colleagues (2008) found that there was no significant impact on reading comprehension scores at schools that were implementing Reading First, though these schools had increased instructional time spent on the components of reading emphasized by the program.

Aside from the debate over whether NCLB is meeting its stated goals, preliminary research has also suggested that there may be a series of unintended consequences associated with the law’s accountability through high-stakes testing. In a recent review of these unintended outcomes, Jones (2007) cited evidence that because NCLB judges schools based on the percentage of students who are ‘proficient’, “some teachers have chosen to spend less attention on students who are not likely to pass the tests, focusing instead on the ‘bubble kids’ who can pass with a little extra help” (p. 73). There is also
evidence that the students who are least likely to pass are being retained, ultimately increasing the dropout rate. Unfortunately, these students are disproportionately ethnic minorities, from poorer families, and English-language learners.

Hursh (2007) reviewed a series of studies that suggested similar consequences. Additionally, he noted that accountability systems were leading schools to focus on “the skills and knowledge that will be tested, neglecting more complex aspects of the subject and, indeed, some subjects altogether” (p. 506). Unintended outcomes such as these have the potential to lead to an increase in the achievement gap in the United States, as well as increasing inequity in ways that may not be captured on standardized tests.

A full discussion of the intricacies of NCLB and its implementation go beyond the bounds of this dissertation. The importance of NCLB for this discussion is its requirement for all schools to make progress for all types of students, thus having potential to close achievement gaps for various minority groups and promote greater equity depending on how attainment of this goal is operationalized. Fusarelli summarized the potential impact of NCLB in a 2004 article, writing

in the best case scenario, by drawing persistent attention to the achievement gap, NCLB may induce parents and the public to pressure educators and policy makers to address persistent inequities in educational opportunities and outcomes. In the worst case scenario, the policy mechanisms and sanctions contained in NCLB will prove unworkable and produce so many unintended negative effects that the cure will be worse than the disease.
The debate over the best way in which to achieve equity is not limited to the United States. In other developed countries as well, this discussion has frequently involved the effectiveness of market-based initiatives and the impact such policies have on equity for disadvantaged students. In Levin’s (1997) discussion of reforms in the United States, England, Canada, and New Zealand, he described the prevalence of market-based mechanisms as an “emphasis on the apocalyptic consequences of failure in education” and says that while “equity goals are still cited, and so is social mobility, the balance has clearly changed in the direction of an economic emphasis” (p. 255). Levin continued to discuss the unintended outcomes associated with market-based systems, one of which was evidence of greater social class segregation in schools in New Zealand.

Whitty and Powers (2000) summarized similar arguments, suggesting that “most of the available evidence does seem to suggest that going further in the direction of marketization and privatization would be unlikely to yield overall improvements in the quality of education and might well have damaging equity effects” (p. 104). They acknowledged that a shift may be on the horizon in some countries. In England, “the need to provide a better balance between consumer rights and citizen rights in education, while recognizing the desirability of some facets of choice and devolution, has led to proposals to put a greater degree of democratic control back in the picture” (p. 104).

Similarly, while Riehl (2005) questioned the motivations of policies such as NCLB in the United States, asking if they are “merely a clever way to certify, under the guise of fairness, a new class of winners and losers in the competitive educational arena”
she acknowledged that because of these changes “more people are paying more attention
to disparities in students’ opportunities to learn and in their achievement…inequities in
conditions such as school resources, teacher quality, and curriculum enactment are
coming to light as educators search for ways to improve outcomes” (p. 422). In this way,
Riehl seems to suggest that, while NCLB and school choice may not be the best
mechanism to improve schools, the emphasis on outcomes has at least drawn attention to
problems that might be solved in other ways.

Equity issues are also garnering attention from multi-country organizations in an
increasingly systematic manner. The Organization for Economic Cooperation and
Development (OECD) has recently conducted a thematic review of the state of equity in
ten countries. The work was based on a comprehensive conceptual framework of the
policy issues related to lifelong learning (Levin, 2003). Using this framework, summaries
of national equity practices and strategies were provided in a series of country notes and
analytical reports. The overarching goal of this project was to develop equity policy
recommendations based on evidence gathered from the participating countries. Similarly,
the European Union has recently carried out a substantial project to develop a series of 29
equity indicators that can be used comparatively across countries (European Group for
Research on Equity in Educational Systems, 2005). These indicators captured a wide
range of issues impacting education, from educational access to civic knowledge to trust
in education institutions.
Such efforts suggest that equity is playing a role in education internationally in many different ways. In several developed countries, this has taken shape through debates of school choice and accountability. Other organizations are emphasizing a comparative approach to equity across countries. In another vein, international organizations that work with developing countries have been “plac(ing) more stress on equitable access to reasonable quality primary schooling as a right that is widely denied to large proportions of the populations of many developing countries” (Lewin, 2007, p. 5). This began with the 1990 Jomtien conference discussed previously, and was continued through the Dakar Global Forum on Education For All in 2000 and programs that have been developed as the result of this forum.

In conclusion, the perspectives on equity have been varied in education, depending upon the year and the context being examined. However, recent events suggest that issues surrounding equity in education are becoming increasingly important in both developing and developed countries. In the former, the success of initiatives to increase access to basic education will depend upon the quality of the education provided and the fairness used to distribute it. In more developed countries, persisting inequities are being highlighted by education reforms and are leading to systematic measurement of equity, and perhaps a change in the way that these issues are addressed in schools.
Defining Equity

Despite the assortment of terms and definitions that have been employed to describe the disparities in education and efforts to resolve them, there is substantial overlap. The following section outlines a number of ways that equity and other related terms have been defined and remarks on the similarities that exist. Throughout the section, the word equity is used to describe these terms in an overarching manner, though the phrasing used by the original authors was employed when pertinent. The section concludes with a description of the equity framework that was employed in this dissertation study, and how it relates to many of the other definitions and related concepts.

Since Coleman’s seminal work during the Civil Rights era, his idea of equality of opportunity has been described as compensatory education, which recognized that, while educational achievement should be independent of students’ social background, it is not, and these social differences require compensation from schools (Gordon, 1974). Gordon went on to temper this idea, defining equal educational opportunity as a recognition that “what children bring to the school is unequal, (therefore) what the school puts in must be unequal and individualized to ensure that what the school produces is at least equal at the basic levels of achievement. Equalization of educational opportunity in a democracy requires parity in achievement at a baseline corresponding to the level required for social satisfaction and democratic participation” (p. 26). However, the way to determine this
baseline was not discussed, and remains a debatable part of defining equality or equity in this way.

Since the realization that equality of inputs does not automatically produce equality of outcomes, definitions of equity have become much more nuanced, in recognition of the complexity of this issue. Walberg and Bargen (1974) attempted to operationalize the idea of equality by summarizing and critiquing a series of definitions with the aim of determining how applicable these definitions would be in Chicago public schools. The six definitions (with several sub-definitions) of educational equality that they gathered ranged from abstract to precise, each with its limitations. The most abstract were negative equality, attained when the “quality of education does not depend on individual, social, ethnic, or other characteristics of the student or where he happens to receive his education”, and egalitarian equality which “spends more on lower ability students so that all students leave school with an equal chance for success” (p. 12). In contrast, a more specific example was racial equality, which “integrates racial or ethnic groups in unit of geographical area” (p. 12). Negative and egalitarian equality resemble Coleman’s idea of compensatory education. While the authors noted that negative equality is the most inclusive, it comes with a level of abstractness that makes application difficult, and the same seems true for egalitarian equality. However, racial equality seems to provide a limited conception of what it means to attain equity, as it does not ensure equitable resources or outputs and focuses on a single manner in which students might face inequity.
In a similar vein, Jencks (1988) presented what he called “five common ways of thinking about equal educational opportunity, each of which draws on a different tradition and each of which has different practical consequences” (p. 518). He outlined each of these interpretations using the example of how they would apply to a single teacher and her classroom. Democratic equality requires the teacher to spend equal time with each student, regardless of ability. Moralistic justice requires the teacher to reward effort and punish a lack of effort, while assuming that student background does not impact perceived effort. The author noted that effort is often difficult to observe, particularly in large institutions, and that a limitation of this perspective is that achievement is used as an inadequate proxy for effort. Weak human justice requires the teacher to compensate students who come from disadvantaged backgrounds with more of her attention (though this does not apply to students who are disadvantaged ‘genetically’). Strong human justice requires the teacher to compensate students who are disadvantaged in any way at all. The final interpretation, utilitarianism, requires the teacher to judge students’ performance and give her attention to the best students because they have ‘earned’ it, while implicitly assuming that students’ chances of being the best are not impacted by their backgrounds. Jencks noted that this last definition focuses on the average welfare of the group, which may not always address inequities for all children.

While Jencks did not explicitly endorse a particular interpretation, he commented on how the ambiguity of the term ‘equal educational opportunity’ gains support from people with varying agendas, but makes progress difficult because of disagreements.
about what it means. This conclusion is similar to those drawn by authors previously mentioned. However, highlighting these differences helps to clarify some of the underlying assumptions associated with these definitions.

Howe (1994) also addressed what he called ‘competing conceptions’ of equal educational opportunity, which were categorized as formal, compensatory, and democratic. Unlike Jencks, however, he viewed these conceptions in a hierarchical fashion. The formal framework defines equal opportunity as a lack of barriers to access based on ‘morally irrelevant’ characteristics (e.g., race, gender). However, ‘morally relevant’ characteristics, such as achievement test scores, were considered acceptable ways to make decisions about educational opportunities under this framework. A compensatory framework uses the same definition, but additionally requires that schools diminish the different ways that individuals are disadvantaged. A democratic framework builds on both of the previous definitions, and adds that educational practices have been developed without the full inclusion of some groups, and that these groups should be represented in curricula and practices to achieve full equality.

Howe believed that the United States was a long way from operating under a democratic framework of equity. He based this judgment on the ‘opportunity to learn’ standards included in the Goal 2000: The Educate America Act made law in 1994. This law was the result of America 2000: An Education Strategy (1991), which provided a set of ambitious goals for the United States to reach by the year 2000 intended to improve education and the country’s place in the global economy.
Howe suggested that United States policy at the time focused on a formal interpretation of equality of educational opportunity, which he dismissed because of its failure “to take into account inequalities experienced by children both in and out of schools” (p. 28). This formal framework seems similar to Jencks’ idea of moralistic justice, as both forms of equity reward student performance without necessarily addressing reasons for some student groups underperforming.

As demonstrated by the previous authors’ use of multiple definitions, equity can be a complex construct with varying interpretations. In recognition of its intricacy, Harvey and Klein (1989) shifted away from trying to compose a definition in favor of developing a comprehensive framework. This framework modeled the inputs, processes, and outputs of education, and provided a series of questions to help determine if equity exists at each stage for different groups of students. The authors did not provide a single definition of equity, claiming that their framework could be applied to various definitions. They did note, however, that the idea of equity has historically been associated with fairness or justice, as opposed to equality, which is associated with sameness. This distinction between equity and equality sets Harvey and Klein’s work apart from some earlier definitions, in which both concepts were considered different forms of equality.

The complexity of Harvey and Klein’s framework is simultaneously a benefit and a detriment. The thorough and systematic approach that these authors took was an important step in attempting to capture the many facets of an education system and the
extent to which they may vary in their equity. In addition, they viewed equity as a goal that should be actively worked toward, though they did not go as far as to explicitly provide ways to measure progress. However, the lack of a single definition or goal could make it difficult to draw overall conclusions or make comparisons between education systems, particularly in light of the range of ways that equity can be interpreted, as discussed above.

Also exploring equity through a framework, Kahle (1998) argued the importance of pursuing equity in mathematics and science and determining ways to measure progress toward this goal. Kahle presented a system (originally presented by Anderson in 1996) that echoed Harvey and Klein’s with a tripartite model that included resources, plans and practices, and outcomes. A complication with working toward equity, Kahle claimed, is defining the groups that should be compared. In a society of ever-shifting social groups such as the United States, racial boundaries that have been used in the past are not entirely valid (e.g., African-American includes those in the middle-class and the severely impoverished). This forces educators to work harder to find variables that can identify need and a definition of equity that can encompass these shifts. In summary, she defined an equitable system as one

…in which all children have the opportunity to achieve to their fullest potential or to the levels specified in the system’s performance standards; that is committed through its allocation of resources to the equitable achievement of all culture-and gender-based student populations; in which participation of diverse groups,
particularly those groups traditionally under-represented in the system, is expected and facilitated; that is accessible (for example, sensitivity to individual variation is considered); and that has policies and procedures established and followed for distributing and utilizing resources in ways that narrow any identified differences between subgroups. (p. 6)

Beyond this definition, she broadly described ways that systems can measure equity, focusing on the importance of measuring trends and the use of value-added models. However, no specific measurement tools were provided because each unique system would require a unique model.

Braun and Kanjee (2004) also put forward a framework concerning equity, but from a different perspective. While the previously discussed frameworks have focused on progress toward equity, in which outcomes (which often involves assessment) play a role, Braun and Kanjee presented a framework for the role of assessment in education. The center of this framework was equity. In this framework, “equity is based on the principle that essentially all children can learn and should be provided with an equal opportunity to do so, irrespective of their background” (p. 308). Encompassed in this definition are the principles of inclusivity, which is a system’s ability to address children’s needs irrespective of their varying backgrounds, and the absence of unfair discrimination, meaning to actively work toward eliminating discriminatory practices and their consequences for students. This latter principle excluded the use of efforts targeted at disadvantaged students intended to improve equity, providing the example of additional
math and science programs for female learners. The authors explicitly acknowledged the connection between their framework and the goals set by international organizations to improve the quality of education for all students.

Lewin (2007) also presented a model that, while not intended to define equity, is useful in thinking about the conceptualization of the issue. The model contained the various factors related to *meaningful equitable access*, whose definition included meaningful learning and equitable opportunities. In this model, Lewin included school process quality and outcomes, district educational governance and resources, community, household characteristics, and individual characteristics. This model was generated as a result of the Millennium Development and Educational for All goals regarding universal primary education. In this outlining of the issues related to equitable access, Lewin indirectly presented a systematic approach to understanding the issue, acknowledging the differential role that a students’ environment can play in achieving equity.

Examining the definitions of equity outlined here, there is a general progression toward emphasis on outputs, and a shift from equality alone to include more nuanced interpretations of equity. Over time, definitions of equality and equity have also become more system-oriented and detailed as understanding of educational processes has become more sophisticated. Many authors had similar perspectives on the issue, and several definitions are complementary. However, many of these definitions also share an ambiguity in exactly how equity might be applied and measured, and how different types
of equity interact. Largely, this seems to be because such specificity goes beyond the authors’ intentions, as opposed to a defect of their conceptualization.

However, Robert Berne and Leanna Stiefel (1984) have developed a comprehensive approach to equity that addresses these aspects. The practicality and specificity of Berne and Stiefel’s work seems to stem from their focus on financial equity, and their view of measurement was influenced by the field of economics. In other words, the framework was originally designed to measure equity between schools in dollars, an easily understood unit of measurement that has real consequences for students. Yet the authors’ ideas can also be applied to input and output variables that are less concrete and can be applied to various levels of an education system, making equity measurement a more tangible concept.

**Berne and Stiefel’s Equity Framework**

Berne and Stiefel conceptualized equity in three ways: horizontal equity, vertical equity, and equal opportunity. Each of these forms of equity can be applied to educational resources, processes, or outcomes. **Horizontal equity** is the most straightforward of the three, defined as equal treatment of equals, so that students who are alike receive equal shares. In the context of the literature on equity, this principle seems the most similar to simple equality. Examples of this provided by the authors were equal expenditures per pupil, equal pupil-teacher ratios, and equal attainment of basic competency levels. However, this principle is intended to measure equal treatment among children who are equal. The authors cautioned that these measures are best applied to subgroups of
students where equality or ‘alikeness’ can be agreed upon, recognizing the subjectivity involved in this process. While this point was not elaborated on by the Berne and Stiefel, it seems an important disclaimer. Depending on one’s assumptions about which subgroups of students are considered ‘equal’, equity could be defined very differently. For example, while one researcher might view all students in a class as equals because they have access to the same learning environment, another researcher might consider some students unequal due to different educational resources in the home.

In cases when students were considered unequal, Berne and Stiefel applied the term *vertical equity*. This is defined as the unequal treatment of unequals, recognizing that children are different and should receive appropriate treatment based on these differences. In some ways, this can be viewed as the pursuit of equality of outputs, which can only be achieved with unequal inputs for students starting with a disadvantage, as pointed out by many of the authors previously discussed. Regarding the principle of vertical equity, Berne and Stiefel recognized the value-laden choices that must be made about what differences between children make them ‘unequal’, and what level of inequality is appropriate for these differences. Some examples that are provided of characteristics that might be used to group children include learning disabilities and inadequate preschool preparation, whereas inappropriate distinctions might be those based on ethnicity or household income.

The final principle in Berne and Stiefel’s framework was *equal opportunity*, defined using the negative: there should *not* be differences among students according to
inappropriate characteristics (e.g., household income, ethnicity). In other words, equal opportunity exists when there is a lack of relationship among inappropriate characteristics and the variable of interest (e.g., expenditures, resources). It is important to note that, while horizontal equity focuses on the distribution of a particular resource or outcome, vertical equity and equal opportunity each depend on a relationship (or lack thereof) between two variables.

This framework, while perhaps more precise in its definitions, echoes many of the ideas put forth in other works discussed here. In an attempt to organize many of the definitions discussed and highlight the commonalities they each have with Berne and Stiefel’s work, Table 2.1 categorizes the definitions according to their three forms of equity for both inputs and outputs. The purpose of this table is to demonstrate how the equity definitions that have been reviewed in previous sections fit in this context, and to reveal any themes that might emerge from past work.
Table 2.1 Equity Definitions Applied to Berne and Stiefel Framework

<table>
<thead>
<tr>
<th></th>
<th>INPUTS</th>
<th>OUTPUTS</th>
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</thead>
<tbody>
<tr>
<td>HORIZONTAL EQUITY</td>
<td>Democratic equality (Jencks)</td>
<td>Compensatory education (Coleman)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Equitable system (Kahle)</td>
</tr>
<tr>
<td>VERTICAL EQUITY</td>
<td>Compensatory education (Coleman)</td>
<td></td>
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<tr>
<td></td>
<td>Egalitarian equality (Walberg &amp; Bargen)</td>
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<td></td>
<td>Weak and strong human justice (Jencks)</td>
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<td></td>
<td>Compensatory framework (Howe)</td>
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<td>Democratic framework (Howe)</td>
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<td></td>
<td>Equitable system (Kahle)</td>
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<tr>
<td></td>
<td>Inclusivity (Braun and Kanjee)</td>
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<td></td>
<td>Lewin (meaningful equitable access)</td>
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</tr>
<tr>
<td>EQUAL OPPORTUNITY</td>
<td>Negative equality (Walberg &amp; Bargen)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Absence of Unfair Discrimination (Braun &amp; Kanjee)</td>
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</table>

Before examining this table, one should first note what does not appear there. Jencks’ (1988) ideas of moralistic justice and utilitarianism, as well as Howe’s (1994) formal framework of equality of opportunity have been purposefully excluded. This is because each of these failed to consider the impact that differences in students’ backgrounds may have on their performance in school, which was at odds with most other ideas of equity. Howe explicitly recognized the shortcomings of the formal framework (discouraging its use) and Jencks made similar points in his discussion of moralistic justice and utilitarianism. Racial equality, as described by Walberg and Bargen (1974), was also excluded because of its specificity to a particular student characteristic. Additionally, Harvey and Klein’s (1989) framework for equity was excluded because, while useful, it failed to define equity in a particular way. Therefore, it could fit into many of the categories in the table above, and one should note that Harvey and Klein stressed the importance of focusing on both inputs and outputs of education.
While these categorizations were not meant to be precise or suggest that all of these definitions are identical, they present a useful way to organize different approaches to equity. This table suggests that existing definitions of equity tend to focus on inputs, particularly from the perspective of vertical equity. Some definitions also focus on equal opportunity and horizontal equity of inputs. However, the author within horizontal equity (Jencks) acknowledged the limitations that such a simple interpretation of equity presents. There were some definitions (Coleman’s and Kahle’s) that also emphasized horizontal equity of outputs (though both are in addition to vertical equity of inputs). These definitions seemed to recognize that the ultimate (though lofty) goal of working toward input equity is to eventually attain equity of outputs.

Viewing previous conceptualizations of equity in light of Berne and Stiefel’s framework, a potential path toward equity seems to target particular subgroups with additional resources (vertical equity of inputs) while working to alleviate the imbalance of resources based on inappropriate characteristics (equal opportunity of inputs) to encourage an equal distribution of outcomes (horizontal equity of outputs). This is expressed graphically below in Figure 2.1, and was the perspective employed in this study.
Measuring Equity in Education

Once a definition has been created to frame the investigation of equity, there remains a number of ways to conduct such an investigation. In the following pages, previous work focusing on the measurement of equity will be presented. This review of the literature focused on measuring equity in terms of educational achievement and processes (as opposed to access in terms of enrollment, for example), and drew on research conducted for this purpose as well as from the field of economics, where equity
methodologies have been employed to examine income distributions. These methods from economics are presented first, followed by a summary of methods suggested by Berne and Stiefel. The remainder of the section presents applications of equity measurement in education, describing work measuring equity within a single educational system and across educational systems, many of which employed the Berne and Stiefel framework.

**Equity Methods Derived from Economics**

A number of techniques used to measure equity have come from the field of economics and have been used to study poverty and the distribution of income. Some of these techniques have also been applied to education to evaluate equity of school finance, viewing student expenditures in a similar manner to personal income. Berne and Stiefel (1984) discussed a series of measurement tools in their original equity framework (p. 19), primarily in terms of horizontal equity as such measures tend to summarize the distribution of data in some way. Many of these techniques were also summarized in economist Amartya Sen’s work *On Economic Inequality* (1997). Some of these are familiar statistics, including the range, restricted range, variance, and coefficient of variation. Other measures are outlined briefly below.

- **Federal Range Ratio** – the restricted ranged divided by the objects (often defined as dollars per student) at the 5th percentile.

- **Relative Mean Deviation** – sum of the absolute value of the differences between each object and the mean, as a proportion of the total objects in the distribution.
- McLoone Index – ratio of the actual sum of objects for students below the median to the sum of objects that would exist if each pupil below the median possessed median objects.

- Standard Deviation of Logarithms – square root of the variance of the natural logarithm of objects.

- Gini Coefficient – shows how far the distribution of objects is from providing each percentage of students (e.g., 5 percent of students) with an equal percentage of object (e.g., 5 percent of objects). This can be represented graphically by the Lorenz curve, shown below in Figure 2.2. In this diagram, the diagonal represents perfect equality, and the curve below it represents the extent that the distribution is unequal (e.g., 10 percent of the population may have 2 percent of the object).

Figure 2.2 Lorenz Curve
Theil’s Index – a measure of inequality based on information theory, using a measure originally intended to measure the information content of a set of probabilistic events. When an individual’s share of the total object is equated to the probability of an event (with a sum of 1 for all objects), this information-content measure becomes an inequality measure that can be used to assess equity between or within groups (Berne and Stiefel, 1984, p. 21). A formula similar to this that does not employ a log transformation like Theil’s Index is the Hoover, or Robin Hood, Index.

Atkinson’s Index – a measure of inequality based on an explicit social-welfare function, which assumes a trade-off between the amount of the object per student and the equity of the objects. In other words, students may need to have less of the object for more equity to be achieved.

The measures described above and their properties have been widely explored in studies of income distribution and poverty. However, they are less frequently used in education, particularly in terms of educational outcomes. This may be due to their inability to summarize some of the more complex relationships that exist in education systems, in which an equal distribution is not always the goal.
**Equity Methods Suggested By Berne and Stiefel**

To capture some of the more complex relationships in education systems more precisely, which often relate to vertical equity and equal opportunity, Berne and Stiefel’s 1984 framework presented some suggested quantitative techniques. Since vertical equity and equal opportunity both tend to measure bivariate relationships, some overlap exists between the methods suggested for each. The authors focused on regression-based measures, noting that these are the most common when working with school finance.

To measure equal opportunity, Berne & Stiefel presented 11 regression-based measures that can be divided into three categories: correlations, slopes, and elasticities. The correlation measures present a simple way to measure the strength and direction of a linear relationship between the variables of interest. Slope measurements for simple, quadratic, and cubic regressions capture the size of the change in a dependent variable associated with a one-unit change in the predictor variable. Similarly, elasticity also measures the relationship magnitude, but in terms of percentage changes instead of per-unit changes that the slope employs. In each of these techniques, the lack of a relationship indicates equal opportunity (e.g., there is no correlation between household income and class size).

When examining vertical equity, two approaches were examined. The first employed many of the same regression techniques, except that a significant relationship indicates vertical equity (e.g., a negative correlation between English language skills at the beginning of the school year and the number of language lessons a student receives).
This forces the researcher to make value judgments about which types of students should receive additional resources (and what those resources should be), without identifying the precise amount these students should receive.

The other approach, weighted dispersion measures, does require the researcher to designate a proper amount of the resource in question. Weighted dispersion measures are modifications of the horizontal equity measures discussed above in which some students are weighted. In a simplistic example, a district could specify that $10,000 should be spent on each student, and that students who did not attend preschool should receive an additional $5,000 in resources. If each student were to receive precisely the funds that were deemed appropriate by the district, then the distribution would be vertically equitable. This would mean that students who did not attend preschool would be (hopefully) able to ‘catch up’ to their peers using the resources provided by their additional $5,000. The extent to which the distribution of student expenditures varies from this ideal suggests vertical inequity.

**Equity Measured Within Educational Systems**

There have been several instances of equity measurement within the United States in the wake of policy changes or court rulings. One example of this was presented by Adams and White (1997), who examined changes in equity following policy changes made in 1989 affecting school finance in Kentucky. These policy changes were the result of a Kentucky Supreme Court ruling (*Rose v. Council for Better Education, Inc.* ) that the education offered by the state was unconstitutional because schools were not providing
equal educational opportunity and adequate education to all students. In the same vein, Rubenstein, Doering, and Gess (1998) examined equity changes in Georgia as a result of similar policy changes. In the 1981 *McDaniel v. Thomas* case, Georgia courts upheld the constitutionality of the state’s schools but acknowledged that there were large disparities in educational spending across districts.

In both cases, the authors measured all three aspects of equity outlined by Berne and Stiefel, focusing on expenditures per pupil (weighting some pupils to measure vertical equity) and fiscal neutrality. The methods used included dispersion statistics (e.g., range, coefficient of variation) to capture horizontal equity and simple measures of association (e.g., correlation, elasticity) to tap the extent to which other forms of equity were met among school districts. The authors compared a series of equity statistics from years before and after the policy reforms to draw conclusions about the effectiveness of state reforms. However, in neither case was there a discussion of the statistical significance of these longitudinal shifts, leaving open the possibility that these changes were due to chance. These are both classic applications of the Berne and Stiefel framework to a single system over time, in which equity among schools is emphasized instead of comparisons between student groups. These studies also focused on education inputs (in terms of dollars), though the impetus for their work was an observed inequity of outputs (student achievement).

More recently, Iatarola and Stiefel (2003) applied the Berne and Stiefel framework in an innovative way to measure equity for inputs and outputs among New
York City schools. The authors used standardized reading test scores to evaluate equity in student performance levels (defined as the percent of students above the 50th percentile, which is considered ‘passing’) and equity in changes in student achievement. For the latter variable, the authors used the difference between third grade school-level data from 1996-97 and fourth grade school-level data in 1997-98, which they called ‘quasi-cohorts’. Input equity utilized school-level measures, such as expenditures, pupil-teacher ratios, and teacher salaries.

When considering these longitudinal changes, the evaluation of vertical equity is particularly interesting. Essentially, this analysis examined the amount of change in achievement in relation to the prevalence of various student populations within a school. For example, in a system that is moving toward equity, one would expect that schools with higher percentages of immigrant students would have larger gains in achievement as the quasi-cohort becomes acclimated to their new country (even if the schools’ overall achievement may be lower). The analysis was accomplished using a regression model with achievement difference scores as the outcome and the percentage of students in a sub-group for each school as the predictor, allowing one to compare the strength of the relationships for different sub-groups.

Iatarola and Stiefel’s analyses are particularly important because they provide an example of the measurement of vertical equity, which is often more difficult to capture than other forms of equity. Additionally, their emphasis on change over time recognized the attainment of equity as a process, and that equity judgments should take into
consideration variation in resources and the range of ‘starting points’ for different participants. However, a limitation of this work was the small number of factors that were considered when examining achievement growth, which did not seem to recognize the complexity of educational improvement.

On a larger scale, Lee (2006) explored changes in achievement gaps before and after the No Child Left Behind Act (NCLB) using data from the National Assessment of Educational Progress (NAEP). While Lee did not explicitly ground his research in a framework of equity, his focus on achievement gaps between racial and socioeconomic groups places the work firmly in this realm. With the goal of determining how effective NCLB had been in reducing inequity in achievement between these groups, Lee developed weighted least square regression models, with multi-level growth models to examine variation across states.

In general, Lee found that reading and math achievement had not improved nationally or at the state level after the passing of NCLB. There was also no evidence that the racial and socioeconomic achievement gaps are closing. However, it is important to note that because these data were observational and NCLB was not implemented to the exclusion of other initiatives, it is not possible to make causal inferences about the effectiveness of NCLB from this research.
**Equity Measured Across Educational Systems**

An early application of the Berne and Stiefel framework (using a version of the framework published in 1978) compared equity in United States school finance to that in Sweden and Norway using school districts as units of analysis (Sherman, 1981). The author focused on measuring horizontal equity (i.e., equality) of expenditures per student. Additionally, Sherman examined the relationship (or lack thereof) between these expenditures and property wealth per pupil, as a proxy for family income. The study made comparisons across school districts within Norway and Sweden, and districts within each state of the United States, so that states were compared individually to the Scandinavian countries.

Sherman found that Sweden and Norway were not more equitable than a large number of states in their expenditures per pupil, though noted that this may be because the policies of these countries focused on resource equity, which may not create expenditure equity. However, they had much higher fiscal neutrality equity, because salary and staffing decisions are made centrally, as opposed to the district-level decisions made in individual states.

This study is an excellent example of a comparative application of the Berne and Stiefel framework, focusing on a single aspect of equity and analyzing it in the context of various education systems. It also demonstrated the differences that may arise between financial equity and resource equity, as the provision of resources may have differing financial consequences in different regions. For example, Norway’s policies emphasized...
the connection between school and community, thus students in sparsely populated areas were not transported to schools outside of their community. This resulted in smaller class sizes, which contributes to higher expenditures per student in these rural areas, though they received the same resources as other students. However, this study’s focus on intra-state equity neglected disparities that may have existed between states, as well as differences that may have existed in terms of vertical equity and equal opportunity.

As educational data at a national and international level have become more widely available, cross-national comparisons have extended in both depth and scope. An example of this was presented by Sherman and Poirier (2007), who used UNESCO data to examine equity across regions within 16 countries. Using expenditures per pupil, pupil-teacher ratios, and enrollment ratios in primary and secondary school, the authors evaluated each country on Berne and Stiefel’s dimensions of horizontal equity and equal opportunity using a range of dispersion statistics and correlations. The authors found that the countries varied in their degree of equity for different variables, and encouraged further analyses that utilized different units of comparison, particularly at the student level. Their work also provided a brief description of equity-related policies in each country to allow the reader to evaluate the results based on the national context.

This research presents several lessons about the potential and limitations for international equity analyses. A wealth of information was presented despite the employment of relatively basic statistical techniques, and interpretation of the results became quite complex when using these techniques to examine each country from a
myriad of perspectives. However, the authors also acknowledged that these numerous analyses could not completely illustrate the state of equity within each country, though they made an important contribution. Most importantly, their efforts to provide some policy information with which to understand the results demonstrates the necessity of context in making use of equity analyses.

Other international analyses have also addressed issues of equity, though many have not been guided by a preexisting theoretical equity framework. In 2004, Woessmann used data from the 1995 Third International Mathematics and Science Study (TIMSS) to analyze the relationship between family background characteristics and achievement in math and science. While the Berne and Stiefel framework was not used, this type of equity analysis is similar to their idea of equal opportunity (i.e., the lack of a relationship between a criterion and a characteristic such as family background). The research focused on eighth grade students in Western European countries and the United States. Woessmann developed a clustering-robust linear regression (CRLR) model to estimate the relationship between various background characteristics and student achievement, using variables such as parental education, books in the home, and whether or not the student was born in the country. In addition, the author examined the heterogeneity of family background effects using quantile regression, investigating whether family background mattered more or less for students at different levels of achievement. While the significance of family background differed across countries, it did not vary by achievement level. Finally, the relationship between family effects and overall country achievement were analyzed for the possibility of a link between equal opportunity and
excellence (which Woessmann calls ‘efficiency’), finding no direct relationship between the two. The use of student-level data and accounting for the hierarchical nature of the data used in this study demonstrate how the rich datasets provided by the IEA expand the possibilities for equity measurement.

Schutz, Ursprung, and Woessmann (2005) conducted similar analyses using TIMSS 1995 data from 54 countries. Building on Woessmann’s (2004) previous findings, these authors developed a theoretical model of how country-level organizational features of education may impact equality of educational opportunity. More specifically, they examined the interaction of the family background effect with policies such as student tracking and preprimary schooling. The authors found that late tracking and a longer preprimary cycle were associated with greater equality of opportunity (i.e., lesser family background effects).

Equity analyses have also been conducted with other large-scale international assessments, such as the work by Lemke, Sen, Johnston, Pahlke, Williams, Kastberg, and Jocelyn (2005) using data from the 2000 Program for International Student Assessment (PISA) of 15-year-old student achievement in reading, mathematics, and science. Focusing on the United States, the authors explored how the characteristics of low-performing students differ from other students. Once these characteristics were identified, they were compared to the characteristics of low-performing students in other countries. To conduct these analyses, relative risk ratios were calculated to determine if a particular characteristic was more or less likely to be observed among low-performing students than
in the rest of the population. While the authors did not explicitly discuss issues of equity and equality in their research, their findings could certainly be interpreted in this way, and their methodology seems well-suited to cross-country equity research. Additionally, the interpretability of the relative risk ratios used in this research makes the results of this study particularly accessible for a broad audience.

Gorard and Smith (2007), however, did explicitly focus on international comparisons of equity in their analyses of PISA 2000 data, focusing on 15 European Union countries. These analyses aimed to develop segregation indices for a range of background variables, to determine how equitable the distribution of students among schools was within each country. For each variable, this index was “the proportion of disadvantaged students who would have to exchange schools within the area of analysis for there to be an even distribution of this group among the population” (p. 19). For these purposes, students were considered disadvantaged if they were in the lowest 10% of the population (for continuous variables) or in the ‘minority’ category (for dichotomous variables). Using these results, the authors discussed features of the various education systems that may contribute to the outcomes.

As discussed in previous sections, European Union countries have also conducted recent substantial work in equity measurement (European Group for Research on Equity in Educational Systems, 2005). Twenty-nine indicators of equity were developed for the purpose of supporting and providing evidence for policy decisions related to education, and to allow for comparisons across systems. Each of these indicators addressed a
different facet of education or a related issue, and often reported simple distribution or
difference statistics for these variables at the national level, using data from a variety of
sources.

A particularly interesting indicator utilized an index originally developed by Sen
to measure poverty, but was transformed to measure education ‘weakness’ using PISA
achievement data. This index combined information about the proportion of ‘weak’
students (those falling below a particular threshold), how far below the threshold these
students were achieving, and the dispersion of these students’ scores (using the Gini
coefficient). This indicator is particularly interesting because it paid particular attention to
equity for those students who were most disadvantaged. In addition to analyzing each of
these indicators separately, the authors ranked each of the countries on the equity of the
context, processes, and results of their education system.

**Benefits of Literacy**

The preceding section has presented some of the approaches that have been
employed to measure equity in education. These efforts have applied various
measurement techniques to a range of resources and outcomes where one would hope to
find equity. The present study focused on equity in reading achievement and the
resources that support literacy development. This focus was selected because of the key
role that literacy plays in supporting positive outcomes for individuals, including
educational attainment, as well as outcomes for the larger society.
Literacy’s value is universally recognized as one of the basic skills and emphasized in primary school. In the PIRLS 2006 countries, 73 percent of students internationally attended schools where reading was emphasized more than other areas in the curriculum (Mullis, Martin, Kennedy, & Foy, 2007). The following section describes some of the research that has explored the link between literacy and positive outcomes. In particular, the relationship between reading and educational attainment and the positive outcomes associated with education are discussed.

**Relationship Between Literacy and Positive Outcomes**

There is substantial evidence that literacy is connected to a series of beneficial outcomes. Many of these outcomes are related to the labor market. The final report of the International Adult Literacy Study (IALS) (OECD, 2000) found that adults in higher socio-occupational categories (e.g., white-collared high-skilled workers) had higher literacy levels than those in lower categories (e.g., blue-collared workers). Unemployment was also found to be negatively related to literacy scores, and the results suggested that literacy may be more important even than educational attainment in explaining the likelihood of being unemployed. Of particular interest in terms of equity, the report also noted that countries with greater literacy inequality also had greater income inequality (as measured by the Gini coefficient). Additionally, IALS data suggested that a number of social benefits were found in countries with higher literacy skills. Those discussed included longer life expectancy and greater political participation by women.
Lamb (1997) drew similar conclusions from his longitudinal study of Australian youth. Reading comprehension skills, measured at age 14, were predictive of a series of outcomes for those students at age 19. Participants with fewer reading skills were more likely to be unemployed and experience long periods of unemployment in their teenage years. They were also likely to be doing manual labor (as opposed to having a white-collar occupation) with lower weekly earnings.

Dougherty (2003) also found that literacy skills were related to future benefits, using longitudinal data from the National Longitudinal Survey of Youth (NLSY). More specifically, this research found that literacy had a positive effect on future earnings and an even stronger effect on college attainment. The author also suggested that efforts to improve literacy may be more effective for students at the lower end of the distribution and the impact may be greater than similar efforts to improve numeracy.

While literacy is related to positive outcomes, the negative consequences of failing to attain basic reading skills may provide an even better argument for their necessity. As early as 1988, Berlin and Sum described the relationship between basic skills (reading, vocabulary, and mathematics) and a series of social problems, also using data from the NLSY. Those who scored low on these basic skill assessments were much more likely to be jobless, drop out of high school, and be dependent on welfare. These findings were true of all sex, race, and income groups. However, minorities from impoverished backgrounds were much more likely to be in the low-scoring group.
DeWalt and colleagues (2004) found that literacy (or lack thereof) was also related to a series of health outcomes. In an extensive literature review, the authors examined the link between reading ability (as measured by reading comprehension instruments) and a range of health activities and problems. The existing research suggested that reading ability was related to knowledge about health and health care, hospitalization, global measures of health and some chronic diseases. Overall, people who were less able to read were 1.5 to 3 times as likely to have adverse health outcomes as those who had higher literacy levels.

Previous research suggests that the outcomes related to literacy can follow us throughout our lives. Unfortunately, the literature also suggests that if these skills are not learned early, they are unlikely to be learned at all. This phenomenon has been coined the ‘Matthew Effect’, and was first applied to reading development by Stanovich (1986). Stanovich summarized existing research and found that

the very children who are reading well and who have good vocabularies will read more, learn more word meanings, and hence read even better. Children with inadequate vocabularies—who read slowly and without enjoyment—read less, and as a result have slower development of vocabulary knowledge, which inhibits further growth in reading ability (p. 381).

Stanovich observed that this ‘rich get richer while the poor get poorer’ scenario had begun to emerge as early as the first grade of primary school. Longitudinal research conducted by Hart and Risley (2003) suggested that differences in vocabulary acquisition
emerged when children were as young as 3 years old and were predictive of later academic performance. Therefore, equity in reading, while always important, is particularly critical early in life, and can have ramifications for literacy development throughout one’s lifespan.

**Relationship Between Literacy and Educational Attainment**

As mentioned above, the IALS data suggested that literacy might be more important in explaining unemployment than educational attainment. In a secondary analysis using the IALS data, Green and Riddell (2001) explored these connections focusing on Canadian data. They found that a positive relationship between literacy and educational attainment (as found in the OECD report) remained even after taking account of the variance explained by sex, marital status, location (province and urban/rural), and work experience. In addition, when predicting earnings they found that one-third of the variance that could be attributed to educational attainment was removed once literacy scores were accounted for. This suggests that research asserting the importance of educational attainment to positive market outcomes may in part be capturing literacy skills, as the two are closely related.

Lamb’s (1997) longitudinal research in Australia that provided similar evidence of the link between literacy and market outcomes also found that reading scores at age 14 were related to educational attainment. Students with higher literacy scores were more likely to complete school, enter university, and enroll in technical and further education courses. In particular, these skills were particularly discriminating for boys in the
Australian study, with only 50 percent of boys with poor literacy skills completing school.

**Relationship Between Educational Attainment and Positive Outcomes**

While research suggests that literacy skills are important on their own for individuals in terms of educational attainment and beyond, a great deal of research has also focused on the impact that educational attainment has on market and social outcomes. Because reading plays a key role in most education, literature centering on educational attainment is also important to keep in mind when discussing the importance of literacy.

George Psacharopoulos has investigated the rate of return for education at the country level, meaning the amount of ‘profit’ a country makes on the money invested in the education system, since the 1970s. In the most recent global update (2002), Psacharopoulos and Patrinos found that patterns discovered previously have remained consistent. One of the strongest findings was that primary school had the greatest return on investment, with diminishing returns for higher levels of education. This was true of both private and social returns on investment, though private returns were greater overall. While the authors did not make this point, it seems important that primary school is often where students gain their basic reading skills. This is particularly true in developing countries, which also saw a greater return in general when compared to wealthier nations.
Mingat and Tan (1996) analyzed the ‘macro’ economic returns to education as a national investment. To do this, they used country-level data in their analyses, so that their results captured additional returns at the societal level that might be excluded if data on individuals had been used. Their findings were similar to Psacharopoulos and Patrinos’ in that education was found to produce high economic returns for countries, and that primary education was found to be the best investment for developing countries. However, these authors suggested that in developed countries, higher education took precedence, suggesting that at some point the investment opportunities at the primary level become saturated.

Other authors have emphasized the lifestyle benefits associated with education. Wolfe and Haveman (2001) conducted an extensive review of these non-market effects. They found evidence of a relationship between schooling and better health for oneself and one’s family members, increased fertility knowledge and more informed choices about fertility, more charitable giving, and less participation in criminal activities. In particular, the authors focused on the intergenerational impact of schooling, finding that one’s schooling was related to more schooling and positive cognitive development of one’s children, better children’s health, and a decreased likelihood that one’s children will have children as teenagers.

There are also non-monetary benefits related to education that are valuable for the larger society. Focusing specifically on the benefits of higher education in the United States, Baum and Ma (2007) reported that adults with higher levels of education had
higher levels of civic participation such as volunteering and voting, and a greater level of openness to others’ opinions. Additionally, the decreased likelihood of unemployment and poverty for these educated adults made them less likely to need assistance from public safety net programs. This allows these resources to be focused on a smaller proportion of the population who are in need.

**Relationship Between Literacy and Student Background Characteristics**

The previous pages have described some of the many benefits associated with literacy and education in general. However, it is a well known reality that not all students have an equal chance at attaining these skills. One’s background plays a large role in cognitive development and academic success, particularly in reading.

Past research has shown that socioeconomic status, and parental education in particular, has a positive relationship with cognitive development, educational attainment, and language proficiency, and that this pattern holds true across many cultures (Bradley & Corwyn, 2002; Haveman & Wolf, 1995). In recent work using PIRLS and Programme for International Student Assessment (PISA) data, it was found that socioeconomic status was related to reading achievement at the fourth grade and at age 15 in every participating country (Willms, 2006).

Another key factor of early literacy development is the language that parents use with their children, and whether or not that corresponds to the language used in schools. In the United States, research has found that language minority students were more likely
to drop out of school and be placed in lower ability groups than their peers with an English background. However, students in this group with better literacy skills in English and their native language had greater overall academic success (Genesee, Lindholm-Leary, Saunders, & Christian, 2005). As immigration continues to increase in many parts of the world, the importance of a student’s home language and the relationship with reading achievement will continue to grow.

The community that students and their families are a part of can also influence their literacy development. In many places, such as in the United States, this is in part due to the fact that schools are largely funded by the local community. Therefore, if the area is economically disadvantaged, the school may lack in resources as a result. It has been found that students in schools without economic advantages are disproportionately taught by teachers with less training and receive less effective instruction (Darling-Hammond, 1996). In more economically developed countries, these disadvantaged areas tend to be in large, urban centers. Recent research focusing on countries with high Gross National Product (GNP) using PIRLS data has found that scores were lower in urban areas, and that school location was an important factor in reading achievement (van Diepen, Verhoeven, & Aarnoutse, 2008).

Conversely, in countries that are developing or undergoing political transition, resources may be more readily available in larger cities, leaving rural areas at a disadvantage. A stark example of this scenario can be found in South Africa, which is still recovering from the inequities of apartheid. In this case, “while some black schools
in townships could be relatively well resourced, in many rural areas schools may consist of no more than mud buildings in which blackboards, books and stationery are almost unheard of” (Taylor & Vinjevold, 2000, p. 170). Similarly, community resources such as newspapers and libraries have been concentrated in urban and suburban areas (where white citizens could have easy access). However, there are current efforts to make such resources available in rural areas as well (Howie, 2007).

Within each of these community types, students’ individual characteristics also play a role in reading development. In recent years, there has been an increasingly prominent gender gap in reading, with boys demonstrating fewer reading skills than girls. Wagemaker and colleagues (1996) explored this gender gap in reading internationally in 32 countries at ages 9 and 14. They found that there was an overall trend favoring girls in the vast majority of countries, but that there were fewer significant differences at age 14 than age 9, suggesting that maturational differences between boys and girls may play a role. Other research has also examined gender differences in affect and motivation, finding that boys often enjoy reading less and have less motivation to do so (Guthrie & Greaney, 1991).

The previous paragraphs have briefly touched on some of the many ways that a student’s background can impact his or her reading development. This is not meant to imply that any of these characteristics directly cause poor reading skills. Instead, many of the characteristics that were described are often associated with a lack of resources and other disadvantages that can make learning to read more difficult for children. Identifying
inequities associated with these broader demographic groups can be a first step in learning how to best support reading development for all types of children.

**Conceptualization of Literacy in PIRLS**

It is clear from the literature that literacy and reading skills benefit individuals as well as their communities, and that background factors may play a role in this development. However, the way that one conceptualizes literacy and its development shapes the way that one may interpret its relationship to various outcomes. This dissertation focused on PIRLS, which is based on a comprehensive assessment framework, beginning with drawing on existing literacy theories to develop a definition of reading literacy. The term reading literacy is used in IEA studies to convey the idea that one should be able to read and use reading skills as tools to attain various personal and societal goals. PIRLS defines reading literacy as

> the ability to understand and use those written language forms required by society and/or valued by the individual. Young readers can construct meaning from a variety of texts. They read to learn, to participate in communities of readers in school and everyday life, and for enjoyment. (Mullis, Kennedy, Martin, & Sainsbury, 2006, p. 3)

Inherent in this definition is the idea that reading literacy requires children to interact with texts of different kinds for a variety of purposes and in a range of contexts. This expansive understanding of what reading literacy entails is reflected in the ambitious assessment design. PIRLS assesses students’ abilities to read for literary experience and
to acquire and use information. To test these skills, students were presented with a literary text such as a story or fable (in the former case) or an informational text such as a scientific article or biography (in the latter case). Each of these passages was followed by a series of reading comprehension items that measured one of four reading processes: focusing on and retrieving explicitly stated information; making straightforward inferences; interpreting and integrating ideas and information; and examining and evaluating content, language, and textual elements. Table 2.2 below presents the percentages of the assessment devoted to each reading purpose and process of comprehension, as described in the *PIRLS 2006 Assessment Framework and Specifications* (Mullis, Kennedy, Martin, & Sainsbury, 2006, p. 5).

<table>
<thead>
<tr>
<th>Purposes for Reading</th>
<th>Processes of Comprehension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Literary Experience</td>
<td>Focus on and Retrieve Explicitly Stated Information</td>
</tr>
<tr>
<td>Acquire and Use Information</td>
<td>Make Straightforward Inferences</td>
</tr>
<tr>
<td></td>
<td>Interpret and Integrate Ideas and Information</td>
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<td></td>
<td>Examine and Evaluate Content, Language, and Textual Elements</td>
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<td></td>
<td>Make Straightforward Inferences</td>
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<td>Interpret and Integrate Ideas and Information</td>
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<td></td>
<td>Examine and Evaluate Content, Language, and Textual Elements</td>
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</tbody>
</table>

The reading achievement information gathered in the assessment was complemented by information about students’ reading behaviors, attitudes, and the environments that support them. In the *PIRLS 2006 Assessment Framework and Specifications*, PIRLS conceptualized the interaction of the environments that shape literacy development according to the model shown in Figure 2.3 (p. 25).
Using this model as a foundation, extensive information was gathered about the contexts for teaching and learning in each participating country. These data were gathered through questionnaires administered to participating students, their parents, teachers, and school principals. Information about the national policies for education and teaching reading in particular was collected through a curriculum questionnaire and a qualitative description of the national context in the *PIRLS 2006 Encyclopedia* (Kennedy, Mullis, Martin, & Trong, 2007). The latter is a publication that contains a chapter written by representatives from each country describing the country’s educational settings and contexts for reading instruction in detail.

This theoretical model, combined with the comprehensive assessment specifications and extensive background data, demonstrates that PIRLS recognizes the complexity of reading development and has taken steps to capture its many facets. This
suggests that conclusions made about an education system and the extent to which its student population’s reading achievement is distributed equitably would be based on a strong foundation of what reading literacy means and how it develops. The ways in which PIRLS accomplishes its goals are described in a more thorough discussion of the assessment design and the 2006 dataset in the following chapter.
**Conclusions**

In summary, the importance of equity in education, while always significant, has fallen in and out of the spotlight in recent history. However, recent trends seem to suggest that it is becoming an increasingly important policy issue, for individual countries as well as multi-national organizations. With this international support comes a growing need to understand and be able to measure the extent to which countries are meeting equity goals. This requires an explicit framework outlining how the construct will be defined. The literature has shown that there is a range of ways to interpret the term ‘equity’, but that there are several common features.

The equity framework developed by Berne and Stiefel is particularly useful because of its ability to represent many of these commonalities and define them in a way that lends itself to practical applications. Past research has demonstrated that equity can be measured, though the breadth and depth of the construct allows for a variety of measurement techniques, each allowing a slightly different perspective and interpretation. The approach taken by each author was shaped by the purpose of the research, the policy issues of interest, and the audience intended to make use of the findings. Each of these aspects was considered in the current study of equity in relation to reading literacy. Past research has demonstrated the link between literacy and education and a host of benefits, suggesting that measuring equity related to this key skill is particularly important. PIRLS provides an excellent vehicle for such a study, as it conceptualizes and measures reading literacy in a comprehensive manner.
Chapter 3

Methods

Introduction

The purpose of this dissertation was to develop a way to measure equity in reading achievement across countries using the PIRLS 2006 international database. This chapter presents a description of the database and the steps that were taken to achieve this goal. This chapter is divided into four major sections. The first section provides a description of PIRLS 2006, including its suitability for equity measurement and features of the data that required special consideration when conducting equity analyses. The second section is a discussion of techniques that were considered as ways to measure equity in the context of PIRLS, and the criteria that were used to evaluate the various approaches. The third section presents the chosen analysis technique, relative risk ratios, and how this was used to make comparisons across countries. A discussion of how this technique was used to conduct more in-depth analyses through logistic regression models for a subset of countries is presented in the fourth section.
PIRLS 2006 International Database

Participating Countries

PIRLS 2006 includes data from over 210,000 students in about 6,750 schools in the 40 countries\(^1\) that participated. Because Belgium has two educational systems, French and Flemish Belgium participated separately in PIRLS and were treated separately in this study, resulting in 41 participants total. These participants, listed below in Table 3.1, represent a diverse group of countries in terms of culture, location, and size, making PIRLS data ideal for an international comparative study of equity in education.

Table 3.1 PIRLS 2006 Participants

<table>
<thead>
<tr>
<th>Austria</th>
<th>Indonesia</th>
<th>Poland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium (Flemish)</td>
<td>Iran, Islamic Rep. of</td>
<td>Qatar</td>
</tr>
<tr>
<td>Belgium (French)</td>
<td>Israel</td>
<td>Romania</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>Italy</td>
<td>Russian Federation</td>
</tr>
<tr>
<td>Canada</td>
<td>Kuwait</td>
<td>Scotland</td>
</tr>
<tr>
<td>Chinese Taipei</td>
<td>Latvia</td>
<td>Singapore</td>
</tr>
<tr>
<td>Denmark</td>
<td>Lithuania</td>
<td>Slovak Republic</td>
</tr>
<tr>
<td>England</td>
<td>Luxembourg</td>
<td>Slovenia</td>
</tr>
<tr>
<td>France</td>
<td>Macedonia, Rep. of</td>
<td>South Africa</td>
</tr>
<tr>
<td>Georgia</td>
<td>Moldova, Rep. of</td>
<td>Spain</td>
</tr>
<tr>
<td>Germany</td>
<td>Morocco</td>
<td>Sweden</td>
</tr>
<tr>
<td>Hong Kong SAR</td>
<td>Netherlands</td>
<td>Trinidad and Tobago</td>
</tr>
<tr>
<td>Hungary</td>
<td>New Zealand</td>
<td>United States</td>
</tr>
<tr>
<td>Iceland</td>
<td>Norway</td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) In PIRLS 2006, the five Canadian provinces of Alberta, British Columbia, Ontario, Quebec, and Nova Scotia worked with IEA procedurally and financially so that they could be reported separately but not collectively as a country in the PIRLS 2006 International Report. However, because these provinces represent 88 percent of the student population in Canada, the data for Canada have been combined for the purposes of this dissertation.
Target Population

The target population for PIRLS was defined as all students enrolled in the grade that represents four years of schooling, counting from the first year of ISCED Level 1, providing the mean age at the time of testing is at least 9.5 years. For most countries, the target grade should be fourth grade, or its national equivalent (Joncas, 2007, p. 36).

This population was chosen because it is the point at which students are generally expected to transition from learning to read to reading to learn, an important turning point in education. The fourth grade is particularly appropriate for a study of equity in reading achievement, because schools have had several years to develop students’ reading skills, but students are still young enough that changes can have an impact on their development.

Sampling Design

PIRLS 2006 drew probability samples from this target population within each country. A two-stage stratified cluster sample design was employed, with the first stage as schools and the second stage being one or two intact classrooms within selected schools. Most countries sampled 150 schools, using an approach that was designed to yield a representative national sample of at least 4,000 students (Mullis, Martin, Kennedy, & Foy, 2007).
To enable appropriate inferences at the country level and across countries, participants were required to meet rigorous sampling and participation standards, with minimal deviations from the international sampling design. The guidelines required that at least 85 percent of both sampled schools and students, or a combined rate of 75 percent, participated in the assessment. The majority of PIRLS countries met and exceeded these high expectations (Joncas, 2007). This rigor ensures that conclusions drawn from the current study about the state of equity in education were based on nationally representative samples, and could be used to make national policy recommendations.

Those countries that did not fully meet the PIRLS sampling requirements were documented in the *PIRLS 2006 International Report* (Mullis, Martin, Kennedy, & Foy, 2007) and in this dissertation. These countries include Flemish Belgium, the Netherlands, Scotland, and the United States, who met the minimum acceptable participation rates only after replacement schools were used (i.e., some originally sampled schools did not participate, and were replaced with similar schools that had been chosen a priori). After including replacement schools, Norway still fell slightly below the minimum overall participation rates.

The sampling design also allowed countries to exclude a small proportion (less than 5 percent) of students from their population who would be difficult to assess (e.g., remote schools, schools for students with intensive special needs). In some cases, namely Bulgaria, Denmark, Georgia, the Russian Federation, and the United States, countries
exceeded this maximum exclusion rate by a small amount. Additionally, Israel excluded more than 20 percent of its fourth grade population.

The PIRLS 2006 database includes a series of sampling weights to ensure that results based on these sample data accurately reflect the attributes of the population, taking into account the sample design, any over-sampling of subgroups, and non-response rates. For the present dissertation study, the total student sampling weight (TOTWGT) was employed for most analyses. This sampling weight inflates the sample size to approximate the size of the entire population and ensures that subgroups are proportionally represented, essentially statistically ‘replicating’ the student population.

**Assessment Instrument**

The PIRLS 2006 reading assessment provided a measure of the reading skills that fourth grade students are expected to possess, using a range of materials that are typically experienced by fourth graders. The assessment consisted of ten authentic reading passages, five of which were for the literary purpose and five for the informational purpose. These passages provided a range of text types that fourth grade students would normally encounter, including short fictional stories and magazine-style articles.

Each passage was followed by a series of multiple-choice and constructed-response items (with values ranging from 1 to 3 points) that measured a range of comprehension processes. The processes of comprehension were: focus on and retrieve explicitly stated information; make straightforward inferences; interpret and integrate ideas and information; and, examine and evaluate content, language, and textual
elements. In total, there were 126 items resulting in 167 score points available for analysis in this dissertation. Two sample passages used in PIRLS 2006, *Antarctica* (informational) and *The Little Lump of Clay* (literary), with accompanying items and scoring guides, are replicated from the *PIRLS 2006 International Report* (Mullis, Martin, Kennedy, & Foy, 2007) in Appendix A.

The PIRLS 2006 passages and items went through an extensive review process by an international panel of reading experts as well as representatives from participating countries. This process not only made certain that the assessment was of high quality and was validly measuring the intended processes of comprehension, but that the material was culturally appropriate in the participating countries. This latter point was critical for attaining comparable scores in an international context. The assessment design and development process are described in detail in the *PIRLS 2006 Assessment Framework and Specifications* (Mullis, Kennedy, Martin, & Sainsbury, 2006) and Chapter 2 of the *PIRLS 2006 Technical Report* (Kennedy & Sainsbury, 2007).

**Booklet Design**

The wide breadth of material included in the PIRLS assessment allowed for a valid and comprehensive assessment of reading achievement. However, this also means that it would have taken nearly seven hours for a student to complete the entire test. This obviously exceeds a reasonable amount of testing time for a single student; therefore, each student was administered only a portion of the exam. This was done using a matrix-sampling design, in which passages and their items (called ‘blocks’) were rotated and
paired up with other blocks, creating 13 booklets that contained two blocks each. Each student was administered a single booklet, resulting in 80 minutes of total testing time. While this design would not be appropriate for making decisions about individual students, it provides a comprehensive picture of reading achievement for student groups.

The booklet design is described in more detail in the *PIRLS 2006 Framework and Specifications* (Mullis, Kennedy, Martin, & Sainsbury, 2006). For the purposes of this dissertation, the design was important in that it allowed for a more thorough assessment and because of the implications it had for data analysis. The fact that each student provided responses to a subset of the assessment had to be taken into consideration when estimating achievement scores.

**Scaling Methodology**

Even though each student only responded to a portion of the test, the goal was to provide a reading proficiency score for each student that can be used in a variety of data analyses. In brief, PIRLS uses Item Response Theory (IRT) scaling in combination with conditioning and multiple imputation to describe student achievement. This approach was originally developed for use in NAEP (Mislevy, Beaton, Kaplan, & Sheehan, 1992), and its use in PIRLS 2006 was described by Foy, Galia, and Li (2007).

An important feature of IRT scaling is that it is capable of estimating a student’s score on a pool of assessment items even if the student has not responded to all items in the pool. This characteristic of IRT makes it particularly appropriate for scaling achievement data from large-scale assessments such as PIRLS that use matrix-sampling
designs for data collection. IRT scaling produces student achievement scores on an assessment by fitting an individual statistical model to each item in the assessment and then combining the information from each model to construct an estimate of student achievement.

Although IRT scaling is well-suited to modeling student data from matrix-sampling designs, like other measurement approaches it gives most reliable results when based on a large number of items. In the context of PIRLS, however, the matrix-sampling design typically means that individual students do not respond to a large number of items, at least for any given reading purpose or comprehension process. In this situation, the individual student IRT scores produced by standard IRT scaling software have been found to be insufficiently reliable as estimates of the achievement of student groups on the assessment as a whole. More importantly, however, when standard IRT scores are used to produce estimates for student groups, the results are biased. To overcome this problem and to improve the reliability of the achievement measurement, PIRLS uses a process known as ‘conditioning’ that combines students’ responses to the items they were administered with information about students’ background characteristics to estimate their performance on the assessment, and, instead of the usual IRT scores provided by the scaling software, produces a family of posterior distributions of achievement for each student that are conditional on the student’s responses to the administered items and on the student’s background characteristics.
To provide student scores that may be used in analyses, PIRLS uses this family of distributions to predict or impute the achievement conditional on students’ item responses and background characteristics. These imputed scores, or ‘plausible values’, are used in analyses in place of actual student scores (as these are not available in this context). PIRLS generates five plausible values for each student and conducts all analyses five times. The average of the results of the five analyses may be taken as the best estimate of the statistic in question. The difference between the results produced by the five plausible values captures the uncertainty that is associated with the use of the different posterior distributions. All five plausible values were used in the analyses for the current dissertation.

**International Benchmarks**

To aid in the interpretation of the PIRLS reading achievement scale, international benchmarks were created at four points along the scale. The PIRLS 2006 International Benchmarks were Advanced (625), High (550), Intermediate (475), and Low (400). A scale anchoring analysis was conducted to describe student achievement at the PIRLS 2006 International Benchmarks. The descriptions help users understand what reading comprehension skills students demonstrated at each level, and the types of items they were able to answer correctly. In the context of equity measurement, the benchmarks provided a way to better understand inequitable achievement outcomes in terms of actual reading skills. In this way, the term ‘inequity’ was given more meaning because one was able to identify specific reading tasks that students could or could not perform.
In brief, students at the Advanced Benchmark were able to integrate ideas across a text to interpret a character’s traits, interpret figurative language, understand organizational features of a text, and begin to examine and evaluate story structure, providing full text-based support. Reading skills displayed by students reaching the High Benchmark were slightly less sophisticated and included complex inferences, interpreting and integrating across a text, and comparing and evaluating parts of a text. Students reaching the Intermediate Benchmark demonstrated that they could identify central events and plot sequences, make inferences, and use features such as subheadings to locate parts of the text. Students reaching the Low Benchmark were able to recognize clearly stated details and make simple inferences from a text. The complete benchmark descriptions and sample items are provided in the *PIRLS 2006 International Report* (Mullis et. al, 2007), and are reproduced in Appendix B.

These short descriptions demonstrate how the level of reading comprehension builds throughout the benchmarks, and show that students reaching the Low International Benchmark displayed only very basic reading comprehension skills when exposed to the PIRLS texts. The threshold of low reading achievement across countries used in this dissertation was the Low International Benchmark. This research explicitly focused on those students who failed to reach this threshold, as these students were unable to demonstrate even basic reading skills, and were at particular risk of not developing proficient literacy skills without some special help or intervention.
**Background Questionnaires**

The PIRLS background questionnaires were designed to provide contextual data to complement the assessment data. The background data offer a wealth of information with which to better understand the environments that support literacy development in the participating countries and have the potential to provide explanations for inequities in educational outcomes. The information gathered by each questionnaire is described below.

- The student questionnaire sought information about literacy-related activities both in and out of school. This questionnaire contained 24 items, with 87 total variables.

- The *Learning to Read Survey* (i.e., parent questionnaire) asked parents or caregivers about literacy-related activities and resources in the home, including those that took place before the student began school. This questionnaire contained 21 items, with 60 total variables.

- The teacher questionnaire gathered information about the classroom structure, reading instruction, and the teacher’s background and training. This questionnaire contained 41 items, with 147 total variables.

- The school questionnaire asked principals about the school’s demographics and resources in addition to its curriculum and policies. This questionnaire contained 26 items, with 107 total variables.

In summary, PIRLS 2006 data were ideal for developing a measure of equity in reading achievement internationally. PIRLS 2006 provides comprehensive information
about reading achievement across countries based on high quality data and a considerable amount of background information related to literacy development. However, the richness of the PIRLS 2006 data is accompanied by complexities that must be considered when conducting equity analyses. The following sections explain the procedures used in this dissertation and how they took these complexities into account.

**Phase 1: Exploring Ways to Measure Equity in Reading Achievement Using PIRLS 2006 Data**

As shown in the literature review of this study, there are a myriad of ways to define and measure equity. A crucial first step of this research was to explore which techniques are appropriate for an international student achievement database such as PIRLS. This portion of the study addressed the first research question: *Using information from a large-scale international assessment, namely PIRLS 2006, how can issues of equity in education achievement be quantified?*

In doing so, one must first establish the criteria for selecting an analysis technique. The six criteria that were used in this study are listed below.

- **Meaningful Results** – The interpretability of the results was a major criterion when evaluating analysis techniques. This was because the overarching purpose of equity research in education is to inform decision-makers, which hinges on the meaningfulness of the analyses.
o **Compares Across Student Groups and Characteristics** – The literature has shown that equity in educational outcomes is intrinsically linked to students’ resources and background characteristics. Therefore, statistics that allow for comparison among subpopulations were desirable.

o **Focuses on ‘At Risk’ Students** – While equity for all students is important, those students who are achieving at the lowest levels of reading are those most at risk of not learning how to read. Analysis techniques that would focus specifically on those students were sought.

o **Concise Presentation** – The large number of countries that participated in PIRLS 2006 allows one to get a sense of how reading and related factors are distributed internationally. To take full advantage of this characteristic of the dataset, statistics that could be easily displayed for 40 countries in a concise manner were preferable.

o **Suitable for Scores Without an Absolute Zero** – Scores on the PIRLS reading achievement scale do not translate into an absolute amount of reading ability. Instead, the scores exist on a scale that is useful for making comparisons, but does not have an absolute zero. Therefore, statistics that rely on an absolute zero were not appropriate for this dissertation.

o **Provides a Basis for Further In-Depth Analyses** – While a summary presentation of equity in reading achievement internationally is important, this is only the first step in equity research. An analysis technique that could be built upon to further explore
inequities highlighted by international comparison and lends itself to more complex analyses of educational factors within a country was sought.

Using these criteria, the analysis approaches used in previous research measuring equity (discussed in the previous chapter) were reviewed to determine the most appropriate approach for this dissertation study.

A large portion of previous equity work has measured the dispersion of the object of interest—in the case of education, this has often been achievement scores. These measures included those suggested by Berne and Stiefel (1984) and many of those derived from the field of economics. This was often a simple description of the distribution of the data, such as the range, restricted range, variance, and coefficient of variation. While these statistics can be very useful in describing concisely how a particular resource or outcome is distributed among students in a concise manner, they do not accomplish much beyond this. They were not designed to make comparisons across student groups or focus on those most at risk, thus making them less than ideal for this research.

Other dispersion measures were more sophisticated, including the Gini Coefficient, Theil’s Index, the Robin Hood Index, and Atkinson’s Index. These measures relied on particular distributions or functions and the extent to which the data at hand deviated from them. However, these were still limited in that they only expressed the way a single variable was distributed (with the exception of Theil’s Index, which could also be used to measure equity between groups). Additionally, these indices were best suited
to variables that have an absolute zero (such as income, where they are frequently applied). This is because there is an assumption that an extreme case of inequity would be one person having all of the resource (e.g., money), and the rest of the population having none. There is no case in PIRLS when one student could ‘own’ all of the reading achievement, thus the results from these indices would not always be useful when applied to PIRLS data.

Another substantial portion of past research in educational equity has relied on regression-based measures of some kind. Some of the most straightforward measures were outlined by Berne and Stiefel (1984) as ways to measure vertical equity and equal opportunity, including correlations, slopes, and elasticities, all of which capture the magnitude of a bivariate relationship. These satisfied several of the criteria of interest in that they are meaningful, concise, can be used to compare groups, and are often applied to variables without an absolute zero. Slopes and elasticities also lent themselves to more complex analyses that could incorporate multiple variables. A drawback of ordinary least squares regression was that it does not explicitly focus on students at the bottom of the achievement distribution. However, logistic regression, which utilizes dichotomous outcomes, could be used to concentrate attention on low achievers. This approach will be discussed further in a later section.

There were also examples of more complex regression techniques being applied to equity measurement. These included hierarchical growth modeling (used by Lee, 2006), clustering robust linear regression, and quantile regression (both used by
Woessmann, 2004). These models provided more detailed descriptions of the relationship between predictors and outcomes. They had many of the same desirable characteristics as less complex regression techniques, and quantile regression in particular could explicitly focus on students at the low end of the achievement distribution. However, with this additional detail comes added complexity, and these approaches often lose some interpretability and succinctness. Therefore, these approaches were considered more appropriate for a within-country analysis as opposed to a summary of equity across a number of countries.

There were also a number of approaches that did not fit neatly into one of these categories. The first of these was Sen’s Index, a poverty measure that was adapted to education by Morlaix (2005) and was used as one of the European Union’s equity indicators (European Group for Research on Equity in Educational Systems, 2005). This index went beyond many indices that capture the dispersion of achievement in that it explicitly focused on students below a particular achievement threshold—those most at risk of failure in school. It presented this information in a concise manner. However, it did not relate achievement inequities to background characteristics. Additionally, the index makes use of the Gini coefficient in its calculations, which may not always be a meaningful measure of dispersion when using achievement scale scores.

Other examples of indices developed to measure equity were the segregation indices used by Gorard and Smith (2004). These indices did present concise summaries that linked achievement to students’ backgrounds, focused on at risk students, and could
be applied to scale scores that do not have an absolute zero. However, they were intended to address equity issues stemming from school segregation, and only provided information about how many students with particular characteristics would need to switch schools to create an even distribution of this characteristic across schools. While this information is important, its utility is limited to particular contexts.

For use with data in an international context, the approach that was considered to be the most suitable was the use of relative risk ratios, as applied by Lemke and colleagues (2005) to PISA data. In light of the six criteria that were used to evaluate approaches to measuring equity in achievement internationally, relative risk ratios were judged to meet all six. More specifically, this measurement approach provided a concise representation of the relationship between low achievement and background characteristics, with a meaningful and intuitive interpretation. Because relative risk ratios relied on a dichotomous outcome (e.g., low achievement vs. non-low achievement), they could be used with achievement scale scores. The use of a dichotomous outcome also related relative risk ratios to logistic regression, which allows for more in-depth explanations of inequities highlighted by cross-country analyses.

When applied to the PIRLS 2006 data, the conciseness and interpretability of relative risk ratios made them suitable for a summary of equity in achievement across 40 countries, while focusing on those students who were most at risk of not learning how to read. Therefore, it was used, in conjunction with logistic regression, to conduct the equity
analyses of this dissertation study. Both techniques are explained in greater detail in the following sections.

**Relative Risk Ratios**

Relative risk ratios (RR) are traditionally used in epidemiological research to explore the relationship between background characteristics and a health outcome. They have been considered the “gold standard among measures of association for many years” in this field (Benichou & Palta, 2005, p. 113). A common example is the relationship between smoking cigarettes (vs. not smoking) and being diagnosed with cancer (vs. not having cancer). When applied to PIRLS data, this becomes the relationship between having a particular background characteristic such as being male (vs. female) and scoring below a particular threshold on the PIRLS assessment (vs. scoring at or above that threshold). Using these dichotomous factors, RR is calculated in the following way.

\[ RR = \frac{P_1}{P_0} \]

In this equation, \( P_1 \) is the percentage of the total group of students with a particular characteristic who are low achievers and \( P_0 \) is the percentage of the total group of students without this characteristic who are low achievers. The ways that ‘low achievement’ was defined in this context is explained in later sections. The resulting ratio expresses the strength of the relationship between these two variables. If there is no

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2 Please note that relative risk ratios are sometimes referred to in the literature as prevalence ratios when applied to cross-sectional data.
relationship, then the RR is 1, indicating that students with the characteristic are just as likely as their peers to be low achievers. Numbers greater than 1 indicate an increased risk of having low achievement, and numbers between 0 and 1 indicate a lesser risk. For example, a RR of 2 means students possessing the characteristic in question are twice as likely as students without the characteristic to be low achievers. Another way to express this is through the excess relative risk, which is calculated using the following formula.

\[ \text{ERR} = (RR - 1)(100) \]

This provides the same information, but transforms it into a percentage increase, so that students with the RR of 2 mentioned above could also be interpreted as being 100% more likely to be low achievers (Achengrau & Seage, 2008). This intuitive interpretation and straightforward calculation makes relative risk particularly appealing when results are being presented to a wide audience.

In addition to the basic relative risk ratio, a weighted average of relative risk ratios is sometimes presented using a technique developed by Mantel and Haenszel. This pooled relative risk ratio is often used when the researcher suspects that the results may be impacted by a confounding variable. An example of this might be the influence of one’s age on the relationship between smoking cigarettes and lung cancer. In such a case, this confounding variable can be used to stratify the data (e.g., group participants by age), and a relative risk ratio can be calculated for each stratum. These stratum-specific results can then be averaged using the Mantel-Haenszel technique, weighting each stratum by
the prevalence of the risk factor; in this case, smoking cigarettes (Aschengrau & Seage, 2008).

**Relation to Odds Ratios**

Relative risk ratios are often compared to odds ratios, as the two methods are similar, though the odds ratios rely on odds and RR on probabilities. However, the odds ratio historically has been used as an approximation of the relative risk in case-control public health studies. In such cases, when the control and treatment groups are of equal size and the outcome of interest is infrequent, the odds ratio and relative risk produce similar results. However, when this is not the case (generally when the outcome occurs in more than 10% of the sample), odds ratios will provide larger estimates than RR when it is more than 1, and smaller estimates than RR when it is less than 1 (Benichou & Palta, 2005; Zhang & Yu, 1998).

This occurs because the odds ratio compares the number of participants with the undesirable outcome to the number of participants with the desirable outcome for each subgroup, then creates a ratio from these odds. In contrast, the RR compares the number of participants with undesirable outcome to the size of each possible outcome overall, creating a ratio from these two proportions.

**Use in Logistic Regression**

One reason for the popularity of odds ratios as a measure of association is their ready use in logistic regression. Logistic regression models involve a categorical dichotomous dependent variable with continuous or dependent predictors used to model
the probability of the outcome occurring. The relationship between the predictors and outcome is nonlinear, as shown by the logistic curve below.

Figure 3.1 Logistic Curve

An increase in the predictor results in a change in the natural logarithm of the odds (i.e., logit) of the outcome (Pedhauzer, 1997). This information is often expressed as an odds ratio for each predictor, which can be interpreted as the number to multiply the odds of the outcome for each one-unit increase in the predictor (Menard, 1995). As stated above, there are particular drawbacks to the use of an odds ratio in some situations. However, the odds ratio can be converted into a relative risk ratio using the following equation (Zhang & Yu, 1998), where $P_i$ is the percentage of students with the characteristic of interest, and $OR$ is the odds ratio.

$$RR = [(1 - P_i)(OR)] + P_i$$
Using this conversion, RR can be calculated using the odds ratios produced in the logistic regression output of most statistical software packages. However, it has been suggested that, while this conversion formula produces unbiased estimates of the RR, it may result in biased confidence intervals (Robbins, Chao, & Fonseca, 2002). Thus, this dissertation reports the odds ratio in addition to the RR produced by this formula for purposes of determining statistical significance.

**Limitations of Relative Risk Ratios**

Relative risk ratios were chosen for these analyses because they suit the purposes of this research. However, as with any analysis technique, they do have some limitations. The first of these is that knowing the relative risk associated with a characteristic does not provide information about the ‘null’ risk, meaning the risk of not having the characteristic (Benichou & Palta, 2005). For example, knowing the risk of attending a rural school does not tell you about the risk of attending a suburban or urban school. It must be decided what the risk factor should be a priori. To compensate for this, the relative risk of both the presence and lack of the characteristic was computed for most variables in this study.

Additionally, relative risk ratios require dichotomous predictors and outcomes. While this can be useful in presenting information in a concise way, there is a loss of information when continuous or polytomous variables are dichotomized. Along these same lines, the results of the analysis are dependent upon the cutpoints chosen to dichotomize the variables. Therefore, these choices were made carefully for background
variables, and the achievement distribution was divided in two different ways to present different perspectives.

Finally, while the relative risk is a useful indicator of the relationship between a student characteristic and low achievement, it does not provide information about the size of the group at risk. This is a limitation, as the severity of the problem and the policy implications for addressing equity issues may vary greatly depending upon the size of the student group in question.

**Relative Risk-Percentage (RRP) Equity Index**

To address this last limitation of the relative risk ratios, a composite index was created to take into account the proportion of the student population with a particular risk factor, called the Relative Risk-Percentage (RRP) Equity Index.

The RRP Equity Index values were computed by weighting the relative risk ratio by the percentage of students possessing the characteristic of interest in the following way, where $P$ is the percentage of students in the overall population with the characteristic of interest.

$$RRP = (RR - 1)(P)$$

Weighting the relative risk in this manner allowed consideration of situations in which a small proportion of students was at a high risk of low reading achievement as differentiated from those in which a substantial proportion of students had a slightly elevated risk of low reading achievement. The weighting resulted in 0 (zero) if there was
no relationship between the characteristic and low reading achievement and the RRP increased as relative risk and the size of the group of interest grew. Because the RRP takes into account the size of the ‘at risk’ group (e.g., the percentage of students attending rural schools), comparisons between countries or different groups within a country were more informative than comparisons based on only the RR. This weighted number was not intended to replace the relative risk ratio—it was merely meant to provide further context to aid in interpretation.

**Phase 2: Cross-Country Analyses Identifying Student Groups At Unequal Risk for Low Reading Achievement**

After identifying an appropriate way to measure equity in reading achievement using PIRLS data, the technique was applied using the PIRLS 2006 international database. Relative risk ratios were used to calculate the ‘risk’ of having low reading achievement associated with particular background characteristics, referred to as risk factors, as measured by the PIRLS 2006 background questionnaires. In relation to the Berne and Stiefel framework discussed in the previous chapter, this phase of analysis aimed to measure equal opportunity to achieve horizontal equity of outcomes. In other words, what are the relationships between background characteristics and low reading achievement that may be unequally inhibiting children’s opportunities to gain basic reading skills?
Defining Low Reading Achievement

An advantage of a large scale international assessment such as PIRLS is that it has the capability to measure students from a wide variety of contexts on the same scale. In terms of equity of reading achievement, this means that the extent to which all students have been able to master basic reading comprehension can be measured. As discussed previously, PIRLS promotes meaningful interpretation of these comparisons through the use of the PIRLS International Benchmarks, which describe what skills students exhibited at various levels of the achievement scale. Therefore, a logical way to classify a student as a low achiever is whether or not the student scored below the Low International Benchmark of 400. The benchmark was defined in the *PIRLS 2006 International Report* (Mullis et. al, 2007) in the following way:

When reading literary texts, students can

- Recognize an explicitly stated detail
- Locate a specified part of the story and make an inference clearly suggested by the text.

When reading information texts, students can

- Locate and reproduce explicitly stated information that is readily accessible, for example, at the beginning of the text or in a clearly defined section
- Begin to provide a straightforward inference clearly suggested by the text (p. 80).

While students reaching the Low International Benchmark were able to show a basic understanding of the text, they did not demonstrate the ability to integrate
information across the text or evaluate the text in any way, skills that were demonstrated by students at higher benchmarks. This suggests that students achieving below the Low International Benchmark—who did not display even these basic skills—were very likely at serious risk of not becoming literate and reaping the many benefits that accompany being able to read.

Across countries, the median percentage of students reaching the PIRLS 2006 Low International Benchmark was 94, meaning that 6 percent of students were classified as low achievers using this definition. However, the number of students reaching the Low International Benchmark varied considerably by country, ranging from 99 percent in Lithuania, Luxembourg, Hong Kong SAR, and the Netherlands to less than 30 percent in Kuwait, Morocco, and South Africa. Table 3.2 presents the percentage of students scoring below the Low International Benchmark in each country, as well with the percentage of students reaching the Low International Benchmark. The countries in Table 3.2 are ordered from the highest to lowest percentage of international low achievers.
Table 3.2 Percentage of Students Scoring Above and Below PIRLS 2006 Low International Benchmark

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage of Students Below Low Benchmark (400)</th>
<th>Percentage of Students Scoring At or Above Low Benchmark (400)</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Africa</td>
<td>78 (1.6)</td>
<td>22 (1.6)</td>
</tr>
<tr>
<td>Morocco</td>
<td>74 (2.0)</td>
<td>26 (2.0)</td>
</tr>
<tr>
<td>Kuwait</td>
<td>72 (1.2)</td>
<td>28 (1.2)</td>
</tr>
<tr>
<td>Qatar</td>
<td>67 (0.7)</td>
<td>33 (0.7)</td>
</tr>
<tr>
<td>Indonesia</td>
<td>46 (2.1)</td>
<td>54 (2.1)</td>
</tr>
<tr>
<td>Iran, Islamic Rep. of</td>
<td>40 (1.6)</td>
<td>60 (1.6)</td>
</tr>
<tr>
<td>Trinidad and Tobago</td>
<td>36 (2.1)</td>
<td>64 (2.0)</td>
</tr>
<tr>
<td>Kuwait</td>
<td>72 (1.2)</td>
<td>28 (1.2)</td>
</tr>
<tr>
<td>Qatar</td>
<td>67 (0.7)</td>
<td>33 (0.7)</td>
</tr>
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<td>60 (1.6)</td>
</tr>
<tr>
<td>Trinidad and Tobago</td>
<td>36 (2.1)</td>
<td>64 (2.0)</td>
</tr>
<tr>
<td>Macedonia, Rep. of</td>
<td>34 (1.6)</td>
<td>66 (1.6)</td>
</tr>
<tr>
<td>2a Georgia</td>
<td>18 (1.3)</td>
<td>82 (1.3)</td>
</tr>
<tr>
<td>Romania</td>
<td>16 (1.8)</td>
<td>84 (1.8)</td>
</tr>
<tr>
<td>Israel</td>
<td>15 (1.2)</td>
<td>85 (1.2)</td>
</tr>
<tr>
<td>Moldova</td>
<td>9 (0.9)</td>
<td>91 (0.9)</td>
</tr>
<tr>
<td>Norway</td>
<td>8 (0.8)</td>
<td>92 (0.8)</td>
</tr>
<tr>
<td>New Zealand</td>
<td>8 (0.6)</td>
<td>92 (0.6)</td>
</tr>
<tr>
<td>Belgium (French)</td>
<td>8 (0.7)</td>
<td>92 (0.7)</td>
</tr>
<tr>
<td>England</td>
<td>7 (1.0)</td>
<td>93 (0.7)</td>
</tr>
<tr>
<td>Scotland</td>
<td>7 (0.8)</td>
<td>93 (0.8)</td>
</tr>
<tr>
<td>Norway</td>
<td>8 (0.8)</td>
<td>92 (0.8)</td>
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<td>New Zealand</td>
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<td>Scotland</td>
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<td>Poland</td>
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<td>93 (0.7)</td>
</tr>
<tr>
<td>Iceland</td>
<td>7 (0.8)</td>
<td>93 (0.8)</td>
</tr>
<tr>
<td>Spain</td>
<td>6 (0.8)</td>
<td>94 (0.8)</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>6 (0.9)</td>
<td>94 (0.9)</td>
</tr>
<tr>
<td>Slovenia</td>
<td>6 (0.5)</td>
<td>94 (0.5)</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>5 (1.0)</td>
<td>95 (1.0)</td>
</tr>
<tr>
<td>France</td>
<td>4 (0.4)</td>
<td>96 (0.4)</td>
</tr>
<tr>
<td>United States</td>
<td>4 (0.6)</td>
<td>96 (0.6)</td>
</tr>
<tr>
<td>Denmark</td>
<td>4 (0.4)</td>
<td>97 (0.4)</td>
</tr>
<tr>
<td>Singapore</td>
<td>3 (0.4)</td>
<td>97 (0.4)</td>
</tr>
<tr>
<td>Chinese Taipei</td>
<td>3 (0.4)</td>
<td>97 (0.4)</td>
</tr>
<tr>
<td>Germany</td>
<td>3 (0.3)</td>
<td>97 (0.3)</td>
</tr>
<tr>
<td>Hungary</td>
<td>3 (0.5)</td>
<td>97 (0.5)</td>
</tr>
<tr>
<td>Austria</td>
<td>2 (0.4)</td>
<td>98 (0.4)</td>
</tr>
<tr>
<td>Sweden</td>
<td>2 (0.5)</td>
<td>98 (0.4)</td>
</tr>
<tr>
<td>Canada</td>
<td>2 (0.2)</td>
<td>98 (0.4)</td>
</tr>
<tr>
<td>Italy</td>
<td>2 (0.4)</td>
<td>98 (0.4)</td>
</tr>
<tr>
<td>Latvia</td>
<td>2 (0.4)</td>
<td>98 (0.4)</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>2 (0.5)</td>
<td>98 (0.5)</td>
</tr>
<tr>
<td>Lithuania</td>
<td>1 (0.3)</td>
<td>99 (0.3)</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>1 (0.3)</td>
<td>99 (0.2)</td>
</tr>
<tr>
<td>Hong Kong SAR</td>
<td>1 (0.2)</td>
<td>99 (0.2)</td>
</tr>
<tr>
<td>Belgium (Flemish)</td>
<td>1 (0.2)</td>
<td>99 (0.2)</td>
</tr>
<tr>
<td>Netherlands</td>
<td>1 (0.3)</td>
<td>99 (0.2)</td>
</tr>
</tbody>
</table>

1 Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.7 of PIRLS 2006 International Report).
2 Nearly satisfying guidelines for sample participation rates after replacement schools were included (see Exhibit A.7 of PIRLS 2006 International Report).
2a National Defined Population covers less than 95% of National Desired Population (see Exhibit A.4 of PIRLS 2006 International Report).
2b National Defined Population covers less than 80% of National Desired Population (see Exhibit A.4 of PIRLS 2006 International Report).
11 Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
While low reading achievement in an international context is a useful way to think about equity, in that it holds all students to the same expectations and assumes that they all deserve the same opportunities, it has some limitations. In those countries where few students were able to reach the Low International Benchmark, nearly all students were at risk of not learning how to read. Even in situations where traditionally disadvantaged student groups are being treated equitably within a country, it is still important to recognize if the student population as a whole is in danger of not developing basic reading skills. This was taken into account in this dissertation, and is discussed further in the following section.

However, even in those countries where reading achievement is low overall, it is important to prioritize and identify students who have the greatest risk of not becoming literate. Similarly, in high achieving countries where most students were able to reach the Low International Benchmark, there may be some student groups that were more likely than others to be at the bottom of the achievement distribution—meaning that there is still room to improve equity in reading. In both cases, defining low achievement as scoring below the Low International Benchmark is not useful in identifying equity issues within their national context. Therefore, a national threshold of low achievement was also considered, which was defined as scoring below the $20^{th}$ percentile within each country. This threshold recognizes that countries have varying levels of resources, and can be useful in identifying risk factors impacting equity in a particular context.
Identifying Global Relative Risk of Low Reading Achievement

As described in the section above, it is still important to consider a country’s overall reading achievement in a global context when examining the equity in reading achievement within a country. In some countries, virtually all students are in danger of not learning how to read. To capture this idea of a country being at risk, the relative risk of students in each country scoring below the Low International Benchmark compared to students in all other PIRLS countries was calculated, referred to as the Global Relative Risk (GRR). For example, what was the risk of students in England scoring below the Low International Benchmark relative to students in other PIRLS countries? These analyses were conducted using SENWGT, which has the properties of TOTWGT, but weights each country to have the same population size. This was done to ensure that each country contributed equally to the analysis, and that the results were not skewed by the large population sizes of a small number of countries.

Categorizing Variables As Risk Factors

An important facet of Berne and Stiefel’s equity framework is the distinction between ‘appropriate’ and ‘inappropriate’ characteristics. In their framework, appropriate characteristics are those that are acceptable criteria by which to assign resources. For example, one could argue that students who do not speak the language of instruction at home should receive additional language instruction. On the other hand, inappropriate characteristics are those that could be argued should not be related to resources or outcomes, such as race or parental occupation.
PIRLS collects a great deal of information about a range of background characteristics related to reading achievement, and it was important to determine how these should be considered a priori. Since this dissertation study focused specifically on the relationship between background characteristics and achievement, and does so for a wide range of cultures, it is not always feasible to decide what is ‘appropriate’ or ‘inappropriate’ for each country. Instead, this work aimed to present the risk of poor reading achievement associated with various characteristics, encouraging individual countries to decide how such inequities might be best addressed through policy. However, this does not mean that the risk factors for all characteristics were treated in the same manner. For the purposes of this work, variables were considered in one of three ways.

- **Student Characteristics** – These were variables that were used to identify groups of students at risk of low reading achievement. These characteristics could not be easily influenced by changes in educational policy, and were often an integral part of the student’s identity. In most cases, these characteristics defined subpopulations of students. Examples of this category include gender, parental education, and the language of the home.

- **Resources** – These were material and human resources available to students that may impact their reading achievement in some way. These included resources that were a part of the school or the home environment. Examples of this category include library access at school, books in the home, and activities done with the child before starting
school. One should note that these resources were not always tangible, and included measures of school safety and school environment.

- **Attitudes and Behaviors** – These were student attitudes, self-concept, and out-of-school activities. While such characteristics are related to reading achievement, they are generally agreed to have a reciprocal effect (Marsh, Koller, Trautwein, Ludtke, & Baumert, 2005). Examples from this category include students’ independent reading habits and enjoyment of reading.

The focus of this dissertation was to identify inequities in reading achievement and provide a way for policymakers to further explore possible reasons for these inequities. For this reason, background characteristics that were categorized as ‘attitudes and behaviors’ were not included in the analyses for this dissertation work. While student affect certainly plays an important role in becoming a skilled and active reader, the reciprocal relationship between reading attitudes and achievement made it difficult to used PIRLS data to draw conclusions about how attitudes impact reading achievement. For example, it would be difficult to know if urban students have fewer reading skills because they do not like to read, or if they don’t enjoy reading because it is a task that they struggle with.

It is also true that this study cannot draw causal inferences about the impact of resources on reading achievement, because the PIRLS data are observational. However, the direction of the relationship between resources and reading achievement was often more clear than the relationship between achievement and attitudes. For example, while the PIRLS data could not be used to conclude that literacy activities before starting
school cause higher reading achievement at the fourth grade, it is clear that reading achievement at the fourth grade did not impact early literacy activities. Similarly, while it seems plausible that having resources in the home such as books or a computer could encourage reading development, it seems less likely that students’ reading abilities would cause their parents to purchase these objects.

**Dichotomizing Variables for Relative Risk Analysis**

Relative risk ratios are based on a dichotomous outcome and dichotomous predictor. Therefore, in the context of the PIRLS data, both the achievement distribution and background characteristics were dichotomized. The former was divided in two ways, according to the two thresholds of low reading achievement. Students who were below the PIRLS 2006 Low International Benchmark (400) on the PIRLS achievement scale were categorized as low reading achievers and students scoring at or above the Low International Benchmark were considered non-low achievers in the international context. Students scoring in the bottom 20 percent of their country’s achievement distribution were categorized as low achievers in their national context, and students in the top 80 percent of the country distribution were considered non-low achievers in the national context. Because performance on the PIRLS achievement scale is represented by five plausible values for each student, each of these cutpoints was calculated five times (once for each plausible value). All subsequent analyses were conducted with each of these five values and the results were averaged, as described in the *PIRLS 2006 User Guide* (Kennedy & Foy, 2007).
Decisions about dichotomizing background variables were based on the distribution of the data internationally, their relation to reading achievement, and evidence from the literature of what is supportive of reading development. The PIRLS questionnaires included a number of items with 4- or 5-point Likert-style response options, so in these cases the best way to combine categories was straightforward. For example, the items asked respondents if they did something Every day or almost every day, Once or twice a week, Once or twice a month, or Never or almost never. Such items were collapsed into At least once a week and Less than once a week. Items that did not have a response that was clearly supportive of reading achievement were excluded from the analyses for this dissertation. An example of such an excluded item would be principals’ reports of the extent to which textbooks are used as the basis for instruction or as a supplement, because it is not clear (without further information) what the most effective role of textbooks would be in a particular school. Appendix C describes the 261 background questionnaire items that were included in the analyses, with collapsed response categories.

**Identifying Student Characteristics As Risk Factors**

The initial phase of calculating relative risk ratios focused on the likelihood of low reading achievement associated with the student characteristics of interest, or risk factors. This addressed the second research question of this study: *In the PIRLS 2006 countries, applying a ‘relative risk’ approach, what is the risk of low reading achievement for fourth grade students associated with the student characteristics of interest?*
To address this question, student characteristics were chosen that have been shown by past research to be related to literacy development, as discussed in chapter 2, and more specifically with reading achievement at the fourth grade internationally (Mullis et. al, 2007). Additionally, the selected student characteristics that were policy-relevant in a wide range of countries and were often associated with easily identifiable subpopulations of students. Essentially, the purpose of Phase 2 of the analyses for this dissertation was to identify student groups impacted by inequity in reading achievement and the extent to which the severity varied across countries. This provides information about equity of outcomes for the international community, and was intended to help countries identify where they might focus their efforts to improve the level of equity in reading achievement for their students.

The relative risk of being a low achiever in reading was calculated for the following student characteristics: gender, school location (i.e., urban/rural), parental education, and language spoken at home. For each of these factors, the characteristic generally associated with lower reading achievement was considered the risk factor, with the exception of school location where both urban and rural schools were examined. Therefore, the relative risk of being a low achiever for boys, students attending an urban or rural school, students whose parents have less than secondary education, and students speaking a language other than the language of the test were each examined. The variables used to measure these characteristics are described in Table 3.3 below, as well as the response categories as they were analyzed.
### Table 3.3 Student Characteristics Variables

<table>
<thead>
<tr>
<th>Demographic Characteristic</th>
<th>Data Provided By</th>
<th>Item Text</th>
<th>Analysis Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Student</td>
<td>Are you a boy or a girl?</td>
<td>Boy / Girl</td>
</tr>
<tr>
<td>School Location</td>
<td>School Principal</td>
<td>How would you characterize the area where your school is located?</td>
<td>Rural / Urban or Suburban</td>
</tr>
<tr>
<td>Parental Education</td>
<td>Parents</td>
<td>Derived variable that reports highest level of education for either Parent based on: What is the highest level of education completed by the child's mother/stepmother/female guardian? and What is the highest level of education completed by the child's mother/stepmother/female guardian?</td>
<td>Less than upper-secondary education / At least upper-secondary education</td>
</tr>
<tr>
<td>Language Spoken at Home</td>
<td>Student</td>
<td>Did you speak &lt;language of test&gt; before you started school?</td>
<td>No / Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>How often do you speak &lt;language of test&gt; at home?</td>
<td>Sometimes or Never / Always</td>
</tr>
</tbody>
</table>

Since these student characteristics were not mutually exclusive (with the exception of attending an urban or rural school), it is possible that these different risk factors are actually describing the same group of students. For example, it seems plausible that, in some countries, many rural students may also have low parental education. Therefore, the extent to which students belonged to multiple student groups of interest was also examined, as well as the relative risk of having low reading achievement associated with these combinations (e.g., the relative risk of low reading achievement for fourth grade boys attending urban schools). This provided additional information about the state of equity for a particular population, and is useful in determining the best way to improve the situations of these students. Risk factor combinations were limited to those that were expected to have an interaction of some kind.
However, as more characteristics were considered simultaneously, the number of students often became quite small, resulting in imprecise analyses and large standard errors. Therefore, characteristic combinations were limited to those that pertained to at least 15 percent of students internationally, on average. Using this criterion, the following combinations of student characteristics were examined.

- Students attending rural schools whose parents have less than a secondary education
- Boys attending rural schools
- Boys attending urban schools

Students with these risk factor combinations were compared to all other students in the country. For example, boys attending rural schools were compared to all girls and all students attending suburban or urban schools in that country. This was done to see if there was any interaction between individual risk factors. If the relative risk ratio for boys attending rural schools was much higher than the results found for boys or students attending rural schools examined separately, this would suggest that the lack of equity for these students cannot be explained by gender or school location alone. This provides further information to identify students who need reading assistance most.

**Phase 3: Within-Country Analyses Exploring the Relationship Between Resources and Student Risk Factors**

The RRP Equity Index was intended to highlight the risk that various groups had of being low achievers in reading in a range of countries. While drawing awareness to situations of inequity, it can also highlight countries that are treating groups that are
traditionally less privileged in an equitable manner. However, once disparities are highlighted, the next step a country might take would be to explore potential reasons for the poor reading achievement associated with these risk factors. This may help identify steps that countries could take to alleviate inequities in reading achievement. The next phase of the analysis presented an example of how countries might conduct such an investigation, addressing the final research question: *For selected PIRLS 2006 countries, to what extent do differences in resources help explain the increased likelihood of low reading achievement for fourth grade students in an ‘at risk’ group?*

The first step of this analysis was to identify the extent to which resource variables were associated with low reading achievement. Then, if the effect of these resources were controlled statistically using logistic regression, was the risk factor (e.g., attending an urban school) still associated with low achievement? These within-country logistic regression models were intended to demonstrate the different ways that issues of inequity can be addressed depending on the unique context of the country. These in-depth questions cannot be addressed for forty countries simultaneously. Therefore, a subset of countries was selected to provide examples of how these questions might be answered within a national context. These countries were selected based on the results of the RRP Equity Index analyses, and a single ‘at risk’ group was the focus of the analysis in each country. The process used to select the countries and variables included in the logistic regression analyses is discussed further in Chapter 4.
Building Logistic Regression Models to Explore Relationship Between Student Characteristics and Resource Risk Factors

Logistic regression models were built to explore the extent to which the low reading achievement that was observed for an ‘at risk’ group could be explained by differences in resources that support reading development. For example, was the disproportionately high risk of having low achievement that was associated with low parental education only about the parents’ educational status, or the fact that less parental education was also associated with fewer reading resources in the home?

Two models were built for each within-country analysis. The first of these, the Base Model, included only the student risk factor of interest. This was intended to provide the total risk associated with the demographic characteristic. The odds ratio associated with the student risk factor was converted to a relative risk ratio using the formula presented previously in Equation 3.

\[
\text{logit}(LOWACH) = \alpha + \beta_{ATRISK} ATRISK
\]

(5)

Where:

LOWACH = PIRLS reading achievement outcome

\(\alpha\) = intercept

\(\beta_{ATRISK}\) = regression coefficient for ‘at risk’ student characteristic

ATRISK = ‘at risk’ student characteristic
The resource risk factors were then added to the Base Model to estimate the reduction in risk associated with the student risk factor once resources were accounted for, creating the Extended Model. If a resource variable included in the Extended Model was not a significant predictor, then it was removed and the model was run again. Using the relative risk ratio associated with the ‘at risk’ characteristic in the Extended Model and comparing it to the ratio from the Base Model, the reduction in risk was calculated.

\[
\text{logit}(LOWACH) = \alpha + \beta_{\text{RES}_1} \text{RES}_{1} + \cdots + \beta_{\text{RES}_k} \text{RES}_{k} + \beta_{\text{ATRISK}} \text{ATRISK}
\]

Where:

- \(LOWACH\) = PIRLS reading achievement outcome
- \(\alpha\) = intercept
- \(\beta_{\text{ATRISK}}\) = regression coefficient for ‘at risk’ student characteristic
- \(\text{ATRISK}\) = ‘at risk’ student characteristic
- \(\beta_{\text{RES}_1,...,\text{RES}_k}\) = regression coefficients for resource variables
- \(\text{RES}_{1,...,k}\) = resource high risk factors

As discussed previously, the proportion of students in each country who scored below the Low International Benchmark varied widely. Therefore, to ensure that the proportion of low achievers was large enough to produce stable solutions, these logistic regression models were built using only the national threshold of low achievement, the 20\(^{\text{th}}\) national percentile, as the outcome. In other words, these logistic regression models were predicting the likelihood that students would score in the bottom 20 percent of their country’s reading achievement distribution.
Software Used for Data Analysis

The majority of the analyses described above were executed using WesVar® 4.3 (Westat, 2007), a statistical software application produced by Westat that is specifically designed to handle complex survey data such as PIRLS. WesVar is able to take into account the complex sampling design and replicate weights that are a part of the PIRLS data, and can be used to produce estimates of relative risk ratios and build logistic regression models. For these reasons, it was chosen for this dissertation.

Creating Data Files

All the variables that were used in this dissertation were created and/or recoded (i.e., dichotomized) using the Statistical Package for the Social Sciences, more commonly known as SPSS® 15.0. To accomplish this task, the original PIRLS files containing data from each source (i.e., student achievement test, student questionnaire, teacher questionnaire, parent questionnaire, school questionnaire) were combined for each of the 41 countries analyzed, resulting in one SPSS file per country. For each file, all background variables used in this dissertation were recoded into dichotomous variables as described in previous sections. Additionally, each of the 5 plausible values were dichotomized in two ways, for the two thresholds of low achievement (Low International Benchmark and national 20th percentile). For example, plausible value 1 was used to create a dichotomous variable with 0 indicating that the student’s achievement score for this plausible value was below the Low International Benchmark and 1 indicating that the score was at or above the Low International Benchmark. Additionally, plausible value 1
was recoded so that 0 indicating that the student’s achievement score for this plausible value was in the bottom 20 percent of the student’s country reading achievement distribution and 1 indicating that the score was in the top 80 percent of the country’s reading achievement distribution. This resulted in 10 achievement variables total for each country. These data files were then imported individually into WesVar, resulting in one WesVar data file for each country.

**Computing Relative Risk Ratios**

To compute the relative risk ratios, the Table function in WesVar was used, creating a 2x2 table for each risk factor with each of the dichotomized achievement variables. For example, a table including gender and the achievement variable dichotomized according to the Low International Benchmark using the first plausible value was created. Within this table, a statistic computing the relative risk ratio (i.e., the relative risk of boys scoring below the Low International Benchmark compared to girls) was created using the Computed Statistics function. The procedure was repeated for each of the five plausible values, and the results were then averaged to produce the results presented in this dissertation. Because WesVar cannot automatically compute the appropriate standard errors for these statistics, the standard errors of these statistics also were averaged even though it was recognized that manually averaging the standard errors in this way underestimated the true standard error by not taking into account the imputation variance. Standard errors were computed in this simplified way for the sake of expedience when exploratory analyses suggested that the deviation from the true standard errors was relatively minimal (less than .05 across countries).
The analysis steps were taken for each of the six risk factors that were explored across the PIRLS 2006 countries. In addition, these steps were taken for all 261 of the background resource variables in the three countries used for in-depth analyses—Germany, Iran, and Romania.

**Computing Global Relative Risk**

Additionally, a WesVar data file for all 41 countries was created to compute the Global Relative Risk (GRR) of performing below the Low International Benchmark. This data file only contained five variables indicating whether each student reached the Low International Benchmark (for each of the plausible values), and 41 dichotomous variables indicating the country a student belonged to. For example, a 0 would indicate that the student was from Germany, and a 1 would indicate that the student was from any country besides Germany. Using these dichotomous variables, the Tables function was used in WesVar to compute the relative risk ratio associated with low achievement in each country. For example, the relative risk ratio for students in Germany performing below the Low International Benchmark, as compared to all other students assessed in PIRLS 2006, was computed.

**Building Logistic Regression Models**

Variables were screened for inclusion in the logistic regression models based on the results of the relative risk ratio analyses using resource variables in Germany, Iran, and Romania. These results were averaged across the five plausible values and were reviewed. Relative risk ratios that were significantly greater than 2, indicating that
students with (or lacking) that particular resource were twice as likely as other students in that country to score below the national 20\textsuperscript{th} percentile, were included in the logistic regression models.

To build the logistic regression models, the Logistic Regression Model function in WesVar was used to build unique models for each of the three countries examined. Within each country, a model was built for each of the five plausible values. All of the results for these models were averaged to produce the results presented in this dissertation.

**Treatment of Missing Data**

If a variable had more than 15 percent of students with missing data, this variable was excluded from the logistic regression models for that country. This was done because the WesVar software automatically deletes cases with at least one variable missing from any logistic regression model. Therefore, this choice was made to prevent excessive amounts of data being excluded from the analyses, resulting in biased inferences. Other treatments of missing data were considered. However, because approaches that would be appropriate were considerably involved and the true goal of these analyses was to present an example of how countries might explore reasons that groups of their students are at risk of not learning how to read, these methods were not used.
Chapter 4

Results

Introduction

This dissertation used PIRLS 2006 data to explore an approach to measuring equity in reading achievement internationally. PIRLS 2006 measured reading comprehension at the fourth grade in a diverse group of 40 countries with a comprehensive and valid assessment. Using these well-respected international data, the overarching purpose of this dissertation was to examine educational equity across the PIRLS 2006 countries based on determining if certain groups of students had a disproportionately high risk of being low achievers in reading. By the fourth grade, it is important for students to be able to use reading for learning, and identifying students lacking essential reading skills is the first step in providing them the assistance necessary to be successful in school.

There are a myriad of ways to define and measure equity in education, reflecting the complexity and intricacy of the educational process and its inputs and outputs. For the purposes of this research, Berne & Stiefel’s (1984) concept of horizontal equity was selected as a way to view equity. That is, equity would exist when students were equally likely to demonstrate basic skills in reading as defined by the PIRLS 2006 International Benchmarks, regardless of their background. However, if fourth grade students with
particular background characteristics were more likely to have low reading achievement as defined by the PIRLS 2006 International Benchmarks than students without those characteristics, this was considered an indication of inequity.

The Low International Benchmark of 400 was chosen from the four PIRLS 2006 International Benchmarks as the threshold of low reading achievement, meaning that students who scored below this point on the PIRLS scale were considered very low reading achievers. Of the four PIRLS Benchmarks, students at the Low International Benchmark displayed the fewest literacy skills. These students were able to recognize clearly stated details and make simple inferences from a text, but did not demonstrate the higher-level skills such as identifying central events or advanced skills such as integrating across the text or evaluating a text. Therefore, students who were not able to demonstrate even the basic reading skills of the Low International Benchmark by the fourth grade were considered at serious risk of not learning how to read.

Approaching equity in education in a way that focuses on students whose outcomes fall below a certain threshold, with particular emphasis on the foundational subject area of reading, coincides with much of the international work that is being done to improve equity in education. In particular, the European Union has set a series of benchmarks in education to be reached by 2010, one of which is to decrease the percentage of students with low achievement in reading, as defined by a set threshold, by 20 percent (Commission of the European Communities, 2008). In a similar vein, a framework of 29 indicators has been developed to measure equity in OECD countries. A
key component of this framework is the idea that inequity exists when particular students are below a threshold that is considered unacceptable (Demeuse & Baye, 2008). This suggests that conceptualizing equity in this way is increasingly recognized and used by researchers and policymakers concerned with these issues.

The approach to equity used in this dissertation was operationalized through the use of relative risk analyses. More specifically, relative risk ratios were used to compute whether there was an unequal likelihood of low reading achievement associated with particular student background characteristics. Relative risk ratios are traditionally used in epidemiological research to explore the relationship between background characteristics and a health outcome. A common example is the relationship between smoking cigarettes (vs. not smoking) and being diagnosed with cancer (vs. not having cancer). Relative risk ratios have been considered the “gold standard among measures of association for many years” in the public health field (Benichou & Palta, 2005, p. 113).3

**Estimating Equity in Reading Achievement Across the PIRLS 2006 Countries**

Each country that participated in PIRLS 2006 has a unique context and faces unique challenges in educating their children, some more difficult than others. The ways that each country addresses these issues and works to educate their children are discussed in the *PIRLS 2006 Encyclopedia* (Kennedy, Mullis, Martin, & Trong, 2007). As one would expect from such a diverse group of countries, there was also variation in average

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3 The formula used to compute relative risk ratios is provided in Chapter 3, equation 1.
achievement levels in PIRLS 2006, as described in the *PIRLS 2006 International Report* (Mullis, Martin, Kennedy, & Foy, 2007). These ranged from the Russian Federation where the average achievement was 565, well above the PIRLS scale average of 500, to South Africa where the average reading achievement was 302. Similar to the range found in average reading achievement levels, there was also substantial variation across countries in the proportion of students who scored below the PIRLS 2006 Low International Benchmark.

Table 4.1 shows the percentage of students within each country who did not reach the Low International Benchmark—the students who are the focus of this dissertation work. In some countries, the majority of students were unable to demonstrate the basic reading skills associated with the Low International Benchmark, such as locating information clearly stated in a text and making simple inferences. These countries included South Africa, Morocco, Kuwait, and Qatar. However, in most (29) PIRLS countries, only a small number (less than 10 percent) of students failed to meet this point on the PIRLS achievement scale.

Table 4.1 also shows the Global Relative Risk (GRR) of performing below the PIRLS 2006 Low International Benchmark. All students should have the opportunity to develop basic reading skills in primary school, regardless of the country they live in. Therefore, this dissertation first considered the risk of very low reading achievement for students in each country as compared to other students around the world. In some countries, even if there was little inequity between student groups, all students may be at
an increased risk of illiteracy in comparison to their peers in other countries simply by virtue of the many challenges facing the country’s educational system. In this sense, the national context itself was considered a risk factor for low reading achievement at the fourth grade.

The GRR estimated the relative risk of fourth grade students in a particular country scoring below the Low International Benchmark in comparison to students in all other PIRLS countries. When applied in this context, the relative risk ratio expresses the strength of the relationship between living in a particular country (vs. living in any other country) and scoring below the Low International Benchmark (vs. scoring at or above the benchmark). If there was no relationship, then the GRR was 1, indicating that students were just as likely as their peers in other countries to be very low reading achievers. Numbers greater than 1 indicated an increased risk of having low achievement, and numbers between zero and 1 indicated a lesser risk. For example, a GRR of two meant students in a particular country were twice as likely as students in other countries to fall below the PIRLS 2006 Low International Benchmark.
Table 4.1 Global Relative Risk (GRR) of Students in Each Country Scoring Below the PIRLS 2006 Low International Benchmark

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage of Students Below Low Benchmark (400)</th>
<th>GRR of Scoring Below the Low Benchmark Compared to Students in Other Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Africa</td>
<td>78 (1.6)</td>
<td>6.3 (0.1)</td>
</tr>
<tr>
<td>Morocco</td>
<td>74 (2.0)</td>
<td>6.0 (0.2)</td>
</tr>
<tr>
<td>Kuwait</td>
<td>72 (1.2)</td>
<td>5.7 (0.1)</td>
</tr>
<tr>
<td>Qatar</td>
<td>67 (0.7)</td>
<td>5.3 (0.1)</td>
</tr>
<tr>
<td>Indonesia</td>
<td>46 (2.1)</td>
<td>3.5 (0.2)</td>
</tr>
<tr>
<td>Iran, Islamic Rep. of</td>
<td>40 (1.6)</td>
<td>3.0 (0.1)</td>
</tr>
<tr>
<td>Trinidad and Tobago</td>
<td>36 (2.1)</td>
<td>2.7 (0.1)</td>
</tr>
<tr>
<td>Macedonia, Rep. of</td>
<td>34 (1.6)</td>
<td>2.6 (0.1)</td>
</tr>
<tr>
<td>Georgia</td>
<td>18 (1.3)</td>
<td>1.3 (0.1)</td>
</tr>
<tr>
<td>Romania</td>
<td>16 (1.8)</td>
<td>1.2 (0.1)</td>
</tr>
<tr>
<td>Israel</td>
<td>15 (1.2)</td>
<td>1.1 (0.1)</td>
</tr>
<tr>
<td>Moldova</td>
<td>9 (0.9)</td>
<td>0.6 (0.1)</td>
</tr>
<tr>
<td>Norway</td>
<td>8 (0.8)</td>
<td>0.6 (0.1)</td>
</tr>
<tr>
<td>New Zealand</td>
<td>8 (0.6)</td>
<td>0.6 (0.0)</td>
</tr>
<tr>
<td>Belgium (French)</td>
<td>8 (0.7)</td>
<td>0.6 (0.1)</td>
</tr>
<tr>
<td>England</td>
<td>7 (1.0)</td>
<td>0.5 (0.1)</td>
</tr>
<tr>
<td>Scotland</td>
<td>7 (0.8)</td>
<td>0.5 (0.0)</td>
</tr>
<tr>
<td>Poland</td>
<td>7 (0.7)</td>
<td>0.5 (0.0)</td>
</tr>
<tr>
<td>Iceland</td>
<td>7 (0.8)</td>
<td>0.5 (0.0)</td>
</tr>
<tr>
<td>Spain</td>
<td>6 (0.8)</td>
<td>0.5 (0.1)</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>6 (0.9)</td>
<td>0.4 (0.1)</td>
</tr>
<tr>
<td>Slovenia</td>
<td>6 (0.5)</td>
<td>0.4 (0.0)</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>5 (1.0)</td>
<td>0.4 (0.1)</td>
</tr>
<tr>
<td>France</td>
<td>4 (0.4)</td>
<td>0.3 (0.0)</td>
</tr>
<tr>
<td>United States</td>
<td>4 (0.6)</td>
<td>0.3 (0.0)</td>
</tr>
<tr>
<td>Denmark</td>
<td>4 (0.4)</td>
<td>0.3 (0.0)</td>
</tr>
<tr>
<td>Singapore</td>
<td>3 (0.4)</td>
<td>0.2 (0.0)</td>
</tr>
<tr>
<td>Chinese Taipei</td>
<td>3 (0.4)</td>
<td>0.2 (0.0)</td>
</tr>
<tr>
<td>Germany</td>
<td>3 (0.3)</td>
<td>0.2 (0.0)</td>
</tr>
<tr>
<td>Hungary</td>
<td>3 (0.5)</td>
<td>0.2 (0.0)</td>
</tr>
<tr>
<td>Austria</td>
<td>2 (0.4)</td>
<td>0.2 (0.0)</td>
</tr>
<tr>
<td>Canada</td>
<td>2 (0.2)</td>
<td>0.2 (0.0)</td>
</tr>
<tr>
<td>Sweden</td>
<td>2 (0.5)</td>
<td>0.1 (0.0)</td>
</tr>
<tr>
<td>Italy</td>
<td>2 (0.4)</td>
<td>0.1 (0.0)</td>
</tr>
<tr>
<td>Latvia</td>
<td>2 (0.4)</td>
<td>0.1 (0.0)</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>2 (0.5)</td>
<td>0.1 (0.0)</td>
</tr>
<tr>
<td>Lithuania</td>
<td>1 (0.3)</td>
<td>0.1 (0.0)</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>1 (0.3)</td>
<td>0.1 (0.0)</td>
</tr>
<tr>
<td>Hong Kong SAR</td>
<td>1 (0.2)</td>
<td>0.1 (0.0)</td>
</tr>
<tr>
<td>Belgium (Flemish)</td>
<td>1 (0.2)</td>
<td>0.1 (0.0)</td>
</tr>
<tr>
<td>Netherlands</td>
<td>1 (0.3)</td>
<td>0.0 (0.0)</td>
</tr>
</tbody>
</table>

- Indicates risk significantly greater than 1
- Indicates risk significantly less than 1
- Severe GRR (Relative Risk Ratio >= 3 for students in this country performing below Low Benchmark, as compared to other PIRLS countries)
- Moderate GRR (Relative Risk Ratio >= 2 and < 3 for students in this country performing below Low Benchmark, as compared to other PIRLS countries)

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.7 of PIRLS 2006 International Report).
‡ National Defined Population covers less than 95% of National Desired Population (see Exhibit A.4 of PIRLS 2006 International Report).
2a National Defined Population covers less than 80% of National Desired Population (see Exhibit A.4 of PIRLS 2006 International Report).
2b National Defined Population covers less than 80% of National Desired Population (see Exhibit A.4 of PIRLS 2006 International Report).
♦ Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
These relative risk ratio estimates were computed by dividing the proportion of students in a country who scored below the Low International Benchmark by the proportion of students in all other countries combined who scored below the Low International Benchmark. Using a hypothetical example, if 50 percent of students in a particular country had low reading achievement as compared to 25 percent of students in all other countries combined, then the GRR value for that country would be 2. This would indicate that students in that country were twice as likely as their peers internationally to score below the Low International Benchmark, a very high likelihood. Recalling the health applications of relative risk, if one were told that he was twice as likely as people in other countries to have cancer, this would cause great concern. In many ways, not learning how to read at a young age can have similarly grim consequences if nothing is done to remedy the situation.

For this reason, countries with a GRR value of at least 2 were highlighted as having a Moderate level of relative risk, and those with a GRR value of 3 or more were categorized as Severe. These cutpoints were chosen because of the face validity associated with the risk levels. Any fourth grade student who is 3 times as likely as other students at the same level of schooling to be lacking basic literacy skills is most likely in a dire situation regarding future success in school if some assistance is not provided. Similarly, GRR values of at least 2 but less than 3 were categorized as a Moderate level of risk compared to other countries, because students in these countries were twice as likely as other fourth grade students to have low reading achievement.
When the GRR values were calculated for the PIRLS countries, there were nine countries where students had a significantly higher risk of scoring below the PIRLS 2006 Low International Benchmark compared to students in other countries. In the majority (29) of PIRLS countries, however, students were significantly less likely than their peers internationally to fall below this reading achievement threshold. Of the countries with relative risk levels significantly greater than 1, students in South Africa (GRR = 6.3), Morocco (GRR = 6.0), Kuwait (GRR = 5.7), Qatar (GRR = 5.3), Indonesia (GRR = 3.5), and Iran (GRR = 3.0) were categorized with a Severe Risk of having poor reading skills as compared to other countries. Trinidad and Tobago (GRR = 2.7) and the Republic of Macedonia (GRR = 2.6) performed slightly better in a global context, though their students were still at a comparatively Moderate Risk of low reading achievement. These risk categories were noted in all subsequent results tables, so that the overall Global Relative Risk of very low reading achievement could be considered alongside the within-country risk for particular student groups.

Looking at Table 4.1, the GRR value for Georgia was not high enough to be categorized as Moderate or Severe, although the relative risk of 1.3 for Georgian fourth grade students was statistically significant. This highlights the difference between statistical significance and the relative risk categorizations. It is possible to have a statistically significant level of relative risk that did not reach the cutpoint of the Moderate category, as was the case for Georgia. This means that these students were still more likely than their peers to be low reading achievers and are worth noting, but that their level of relative risk was fairly low.
The Relative Risk-Percentage (RRP) Equity Index

As was shown with the Global Relative Risk (GRR) estimates presented in the previous section, relative risk can be a useful approach to measuring equity. However, the situation becomes more complex when a particular student characteristic is considered across a range of countries. In addition to the level of relative risk varying across countries, the proportion of students with the risk factor, or size of the ‘at risk’ group, varies as well. The size of the ‘at risk’ group is an important factor to consider when comparing countries and when making policy decisions to assist these students. To take account of both the level of relative risk and the percentage of students in the ‘at risk’ group, the Relative Risk-Percentage (RRP) Equity Index was created.

The RRP Equity Index combined information about the relative risk of low reading achievement associated with a particular risk factor and the percentage of students in the population who possess that risk factor, such as attending a rural school. In the RRP, the relative risk of not reaching the PIRLS 2006 Low International Benchmark is weighted by the percentage of students in the ‘at risk’ group⁴. The RRP values allow for initial comparisons between countries where the group of students being considered has a lower relative risk but a larger number of students with the risk factor and countries where the group has a higher relative risk but a smaller number of students with the risk factor. When the RRP Equity Index values were computed for the ‘at risk’ student groups in the 40 countries that participated in PIRLS 2006, values ranged from 0

⁴ The formula used to calculate RRP Equity Index values is provided in Chapter 3, equation 4.
to 270. In general, however, the values were fairly small, with an average RRP value of 30.

To complement the RRP Equity Index values with descriptive information about the degree of inequity existing in each country, categories were created for the RRP Equity Index values based on judgments of the most serious scenarios of inequity in reading achievement that impacted the largest number of students. Cutpoints were created for both the range of relative risk ratios and for the size of the ‘at risk’ group, while also maintaining a manageable number of categories.

The criteria for the relative risk dimension of the RRP Equity Index categories were identical to those used for Global Relative Risk, and were chosen for similar reasons. Relative risk ratios of 3 or higher were considered Severe, because these fourth grade students are at least three times as likely as their peers to have poor reading skills and potentially never gaining basic literacy skills without some form of intervention. It seems apparent that students who have such an inflated likelihood of not learning how to read based on demographic characteristics out of their control are in a serious situation. Similarly, student groups with relative risk ratios of 2 to less than 3 were labeled as being at Moderate Risk compared to other students. While they are slightly better off than students in the Severe category, being twice as likely as other students for potential illiteracy is a serious indication of inequity of educational outcomes.

When considering the second dimension of the RRP Equity Index, the percentage of students in the ‘at risk’ group, 50 percent (or higher) of students with the risk factor
was classified as a ‘high’ percentage. This percentage was chosen for this dissertation as a conservative boundary. It is difficult to refute that there is a substantial problem meeting the needs of a particular group of students when the group comprises the majority of students in a country and have a disproportionate risk of low reading achievement relative to their peers.

Combining these two dimensions, four categories were created for classifying the results of the RRP Equity Index.

- **SRP** indicates a severe level of risk (relative risk ratio >=3) and a high percentage of students in the ‘at risk’ group (>= 50 percent). This was considered the most critical inequity scenario.

- **SR** indicates a severe level of risk (relative risk ratio >=3), but without a high percentage of students in the ‘at risk’ group (< 50 percent).

- **MRP** indicates a moderate level of risk (relative risk ratio >=2 and < 3) and a high percentage of students in the ‘at risk’ group (>= 50 percent).

- **MR** indicates a moderate level of risk (relative risk ratio >=2 and < 3), but without a high percentage of students in the ‘at risk’ group (< 50 percent).

The relationship between the RRP Equity Index values and the RRP Index categories is shown graphically below in Table 4.2.
Table 4.2 Relative Risk-Percentage (RRP) Equity Index Categories

<table>
<thead>
<tr>
<th>Percentage of Students In 'At Risk' Group</th>
<th>2</th>
<th>2.5</th>
<th>3</th>
<th>3.5</th>
<th>4</th>
<th>4.5</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative Risk Ratio</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>90</td>
<td>90</td>
<td>135</td>
<td>180</td>
<td>225</td>
<td>270</td>
<td>315</td>
<td>360</td>
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<tr>
<td>80</td>
<td>80</td>
<td>120</td>
<td>160</td>
<td>200</td>
<td>240</td>
<td>280</td>
<td>320</td>
</tr>
<tr>
<td>70</td>
<td>70</td>
<td>105</td>
<td>140</td>
<td>175</td>
<td>210</td>
<td>245</td>
<td>280</td>
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<tr>
<td>60</td>
<td>60</td>
<td>90</td>
<td>120</td>
<td>150</td>
<td>180</td>
<td>210</td>
<td>240</td>
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<tr>
<td>50</td>
<td>50</td>
<td>75</td>
<td>100</td>
<td>125</td>
<td>150</td>
<td>175</td>
<td>200</td>
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<td>40</td>
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<td>80</td>
<td>100</td>
<td>120</td>
<td>140</td>
<td>160</td>
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<tr>
<td>30</td>
<td>30</td>
<td>45</td>
<td>60</td>
<td>75</td>
<td>90</td>
<td>105</td>
<td>120</td>
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<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>35</td>
<td>40</td>
</tr>
</tbody>
</table>

SRP = Severe (Risk Relative Risk Ratio >= 3) and High Percentage of Students in 'At Risk' Group (>= 50)
SR = Severe (Risk Relative Risk Ratio >= 3)
MRP = Moderate Risk (Relative Risk Ratio >= 2 and < 3) and High Percentage of Students in 'At Risk' Group (>= 50)
MR = Moderate Risk (Relative Risk Ratio >= 2 and < 3)

These categories are intended to give a descriptive sense of the extent of the inequity for particular student groups in each country to complement the information provided by the RRP Equity Index values. For example, the RRP Equity Index value of 50 could appear in several categories. In the table above, it is shown in the second row from the bottom as part of the SR category, as well as in the fifth row from the bottom as part of the MRP category. These two scenarios represent very different types of inequity, and would require very different remedies. The first example, in the SR category, represents a case where 20 percent of students are three and a half times as likely as their peers to score below the PIRLS 2006 Low International Benchmark. The second example, in the MRP category, represents a case where half of the population is twice as likely as the other half of the population to be below this reading achievement threshold.
However, within each of these categories the RRP Equity Index values are a useful way to indicate the magnitude of inequity in reading achievement. Shown in the seventh row from the bottom of the table in the MRP category, for example, an RRP value of 70 (where 70 percent of the population is twice as likely as other students to have low reading achievement) is certainly of more concern than the value of 50 in the MRP category discussed above. Therefore, RRP Equity Index values were used to sort and compare countries within each of these categories, but are best considered in conjunction with the component parts of the index.

**RRP Equity Index Results for Students Whose Parents Have Less than Secondary Education**

Both PIRLS 2001 and PIRLS 2006 found that level of parental education was strongly related to students’ reading achievement, with students whose parents were more highly educated having higher average reading achievement and those with lower parental education having lower reading achievement (Mullis et al., 2007; Mullis et al., 2003). The PIRLS findings were pervasive across countries, and consistent with decades of reading research showing that higher socioeconomic status, and parental education, in particular, has a positive relationship with cognitive development, educational achievement, and language proficiency, and that this pattern holds true across many cultures (Bradley & Corwyn, 2002; Haveman & Wolf, 1995).

Table 4.3 presents the RRP Equity Index results across the 40 PIRLS 2006 countries for fourth grade students whose parents had less than secondary education. The large number of shaded countries indicates that there was inequity for low achievement in
reading associated with this student characteristic in a substantial number of countries. In fact, the RRP Equity Index results showed more disparity associated with this ‘at risk’ characteristic than any other considered in this dissertation.

The first column in the table contains the category and value for the RRP Equity Index. For the equity analyses conducted for students with parents with low levels of education, 20 of the PIRLS 2006 countries fell into the SR category. The SR category indicates an RR of at least 3 but less than 50 percent of the students in the ‘at risk’ group. This means that in all 20 countries students whose parents had less than secondary education were at least three times more likely to be low achievers in reading than their classmates with better-educated parents.
Table 4.3 RRP Equity Index for Low Reading Achievement Internationally in PIRLS 2006 Countries for
Fourth Grade Students Whose Parents Have Less than Secondary Education

RRP Equity
Index
Country

Category

2a
2b

2a

2a
‡
■

□

†
■
■
□
■
■
■
2a
†2a

†
2a
†2a

Germany
Hungary
Poland
Romania
Spain
Slovak Republic
England
Singapore
Bulgaria
Israel
Belgium (French)
New Zealand
Sweden
Denmark
Iceland
Slovenia
Austria
Chinese Taipei
Canada
Norway
Iran, Islamic Rep. of
Moldova
Macedonia, Rep. of
France
Scotland
Indonesia
Morocco
Trinidad and Tobago
South Africa
Qatar
Kuwait
Georgia
Belgium (Flemish)
Hong Kong SAR
Italy
Latvia
Lithuania
Luxembourg
Netherlands
Russian Federation
United States

SR
SR
SR
SR
SR
SR
SR
SR
SR
SR
SR
SR
SR
SR
SR
SR
SR
SR
SR
SR
MRP
MR
MR
MR
MR

~
~
~
~
~
~
~
~
-

Percentage
of Students
Below Low
Benchmark

Value

270
121
107
91
84
67
62
62
48
46
46
34
29
24
23
22
21
16
12
8
119
52
45
23
19
60
34
23
18
8
4
3
~
~
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3
3
7
16
6
6
7
3
5
15
8
8
2
4
7
6
2
3
2
8
40
9
34
4
7
46
74
36
78
67
72
18
1
1
2
2
1
1
1
2
4

(0.3)
(0.5)
(0.7)
(1.8)
(0.8)
(0.9)
(1.0)
(0.4)
(1.0)
(1.2)
(0.7)
(0.6)
(0.5)
(0.4)
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(0.5)
(0.4)
(0.4)
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(1.6)
(0.9)
(1.6)
(0.4)
(0.8)
(2.1)
(2.0)
(2.1)
(1.6)
(0.7)
(1.2)
(1.3)
(0.2)
(0.2)
(0.4)
(0.4)
(0.3)
(0.3)
(0.3)
(0.5)
(0.6)

Percentage
of Students
Whose
Parents Have
Less than
Secondary
Education

36
13
39
29
31
6
18
19
20
11
19
10
7
11
11
6
5
5
5
4
65
44
24
13
15
66
79
26
41
23
19
4
12
34
34
5
3
44
16
5
-

(1.3)
(1.5)
(1.2)
(2.1)
(1.6)
(0.8)
(1.3)
(0.8)
(2.1)
(1.1)
(1.2)
(0.7)
(0.7)
(0.8)
(0.5)
(0.5)
(0.4)
(0.8)
(0.5)
(0.4)
(2.0)
(1.5)
(1.3)
(0.9)
(1.3)
(1.9)
(1.2)
(1.3)
(1.4)
(0.6)
(1.1)
(0.9)
(0.8)
(1.6)
(1.4)
(0.6)
(0.4)
(0.7)
(1.0)
(0.5)
-

RR of Low
Percentage
Achievement
of Students
Below Low Internationally
for Students
Benchmark
Whose Parents Whose Parents
Have Less than Have Less than
Secondary
Secondary
Education
Education

82
60
70
63
62
44
49
50
46
39
44
32
28
28
28
23
21
39
15
11
85
63
47
29
28
79
84
40
50
29
22
7
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~
~
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-

(4.9)
(8.5)
(3.3)
(3.7)
(6.0)
(8.0)
(6.6)
(4.0)
(5.8)
(4.2)
(3.7)
(4.4)
(8.5)
(5.2)
(3.5)
(2.8)
(4.1)
(4.4)
(3.9)
(2.2)
(1.3)
(3.8)
(2.1)
(4.6)
(6.3)
(1.8)
(1.2)
(2.0)
(1.2)
(0.8)
(1.3)
(1.8)
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8.6
10.6
3.8
4.1
3.7
12.3
4.5
4.3
3.4
5.0
3.4
4.4
5.2
3.2
3.1
4.6
5.4
4.4
3.4
3.1
2.8
2.2
2.9
2.7
2.3
1.9
1.4
1.9
1.4
1.3
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1.7
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(2.7)
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(0.6)
(0.9)
(2.8)
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(0.8)
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(0.6)
(0.2)
(0.4)
(0.2)
(0.6)
(0.7)
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-

Percentage of
RR of Low
Students
Achievement
Below the 20th
Nationally for
Percentile
Students Whose
Nationally Whose
Parents Have
Parents Have Less
Less than
than Secondary
Secondary
Education
Education

62
35
64
59
53
23
41
38
39
36
36
24
16
22
21
15
13
26
9
9
90
58
55
25
28
84
89
45
57
39
28
7
27
45
53
10
6
69
30
13
-

(2.3)
(4.1)
(2.1)
(3.5)
(3.3)
(3.7)
(3.7)
(1.5)
(4.5)
(3.6)
(2.5)
(2.3)
(2.1)
(2.1)
(1.6)
(1.4)
(1.3)
(1.6)
(1.0)
(1.5)
(1.4)
(2.6)
(2.5)
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(4.2)
(2.1)
(2.0)
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(1.6)
(2.0)
(2.5)
(2.8)
(1.9)
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2.9
3.7
2.8
3.5
2.6
4.6
3.3
2.7
2.3
4.5
2.4
2.8
2.6
2.3
2.2
2.8
3.0
2.3
1.9
2.5
4.2
1.8
4.0
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2.2
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2.3
2.3
1.9
2.1
1.7
1.7
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1.6
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2.1
1.9
2.9
2.2
3.1
-

(0.3)
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(0.4)
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(0.5)
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(0.3)
(0.6)
(0.2)
(0.4)
(0.2)
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(0.3)
(0.4)
(0.2)
(0.1)
(0.1)
(0.2)
(0.4)
(0.2)
(0.1)
(0.2)
(0.3)
(0.3)
(0.2)
(0.2)
(0.3)
-

SRP = Severe Risk (Relative Risk
Ratio >= 3) and High Percentage
of Students in 'At Risk' Group
(>= 50)

h
h
h
h

SR = Severe Risk (Relative
Risk Ratio >= 3)

h
h
h
h

MRP = Moderate Risk (Relative
Risk Ratio >= 2 and < 3) and
High Percentage of Students
in 'At Risk' Group (>= 50)

h
h
h
h

MR = Moderate Risk (Relative
Risk Ratio >= 2 and < 3)

h
h
h
h
h

h Indicates risk signficantly

greater than 1

h
h
h

i Indicates risk signficantly

h

less than 1

h
h
h
h
h
h
h
h
h
h
h
h
h
h
h
h
h
h
-

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.7 of PIRLS 2006 International Report ).
‡ Nearly satisfying guidelines for sample participation rates after replacement schools were included (see Exhibit A.7of PIRLS 2006 International Report ).
2a National Defined Population covers less than 95% of National Desired Population (see Exhibit A.4 of PIRLS 2006 International Report ).
2b National Defined Population covers less than 80% of National Desired Population (see Exhibit A.4 of PIRLS 2006 International Report ).
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
- Indicates data not available
~ Indicates insufficient data to report results
■

Severe GRR (Relative Risk Ratio >=3 for students in this country performing below Low Benchmark, as compared to other PIRLS countries)

□

Moderate GRR (Relative Risk Ratio >=2 and < 3 for students in this country performing below Low Benchmark, as compared to other PIRLS countries)

136


Germany had a particularly high RRP Equity Index value (270) because German fourth grade students with poorly educated parents were nearly nine times more likely than their classmates to fall below the PIRLS 2006 Low International Benchmark. Hungary and Poland also had values greater than 100, followed by Romania and Spain (91 and 84, respectively). Among the five countries with the highest RRP Equity Index values, Hungary had a slightly different pattern than the other four countries. Hungary had 13 percent of its fourth grade students with parents with less than secondary education and these students were nearly 11 times more likely than their classmates to be low achievers in reading. The other four countries had somewhat more students (approximately one-third of the population) than Hungary in the ‘at risk’ group, but, with the exception of Germany highlighted earlier, a somewhat lower relative risk ratio for these students (ranging from 3 to 4).

Iran was categorized as MRP despite an RRP Equity Index value greater than 100, because the relative risk (2.8) for students whose parents had less than secondary education did not quite meet the criteria of 3 for being categorized as Severe. However, Iranian fourth grade students whose parents had less than secondary education were nearly at three times the risk of having low reading achievement and Iran was one of the few countries with a large percentage of students in the ‘at risk’ group. Nearly two-thirds of the fourth grade students (well over the 50% cutoff) in Iran had parents with less than secondary education. Four other countries were categorized as MR including Moldova,
Macedonia, France, and Scotland. This indicates RRs of at least 2 but lower than 3, meaning that students in the ‘at risk’ group were at least twice as likely as their peers to be lacking fundamental reading skills. For these four countries, the size of the ‘at risk’ group varied considerably from almost half in Moldova (44%), to about one-fourth in Macedonia (24%), to smaller percentages in France and Scotland (13-15%).

Looking across the various columns in Table 4.3, from the second column showing the percentage of students in each country below the PIRLS 2006 Low International Benchmark, it can be seen that there was not any particular relationship across countries between this percentage and those students having parents with less than secondary education being more or less likely than their classmates to be below the Low Benchmark. In general, the Severe Risk countries had comparatively few students below the Low Benchmark. With 15 to 16 percent, Romania and Israel had the highest percentages and the rest of the countries had from 2 to 8 percent.

The third column shows the percentage of students in the ‘at risk’ group for each country. There was an enormous range across the countries in the percentage of students whose parents had less than secondary education, but the size of this percentage was not necessarily an indicator of inequity. Morocco had the highest percentage of students (79%) whose parents had less than secondary education, followed by Iran and Indonesia (65-66%) and then Moldova, South Africa, and Luxembourg (41-44%).

The percentage of students in each country achieving below the PIRLS 2006 Low International Benchmark in the ‘at risk’ group is shown in the fourth column. If there was
equity of reading achievement for this group, the percentage of students below the Low Benchmark whose parents had less than a secondary education would be equivalent to the percentage of students in the country as a whole whose parents had less than secondary education (shown in previous column). That is, students whose parents had less than secondary education would be distributed across the range of reading achievement in the same proportions as the rest of the students in the country. The extent to which students whose parents had less than a secondary education were overrepresented in a country’s percentage of students below the Low Benchmark indicates inequity for this group.

The relative risk ratio results, shown in column five, are a way of quantifying the degree of inequity associated with students in the ‘at risk’ group being more likely than their peers to lack essential reading skills by the fourth grade. RR results significantly greater than 1 (at the .05 level) are designated with the up arrow. For example, Indonesia and Morocco, two countries with very high percentages of students whose parents had less than secondary education, have significant RR’s of 1.9 and 1.4. Indonesia, in particular, with an RRP Equity Index of 60, is very close to being an MRP country, but just missed having a RR of 2.

The last two columns in Table 4.3, columns six and seven, contain the results for relative risk analyses that used the national 20th percentile as the threshold for low reading achievement in each country. These analyses complement the primary analyses based on the percentages of students falling below the PIRLS 2006 Low International Benchmark. For these analyses, students in some countries were better or worse readers
than students in other countries. However, for equity to exist across countries, it needs to exist within countries so that no particular student groups are overrepresented among the poorest readers.

Thus, column six presents the percentage of students below the 20th percentile whose parents have less than secondary education. Parallel to the previous discussion about the percentages of ‘at risk’ students below the Low International Benchmark, the degree to which the percentage of ‘at risk’ students below the 20th percentile exceeds the percentage of students whose parents had less secondary education in the country as whole indicates the degree of inequity for that group in being overrepresented among the country’s lowest achievers in reading. The RR results shown in the last column (seven) are a way of quantifying the degree of inequity within each country for students whose parents had less than secondary education being among the poorest readers in the country.

The RR results associated with fourth grade students whose parents had less than secondary education being more likely than their peers to be among a country’s lowest achievers in reading show that every PIRLS 2006 country had some degree of inequity for this group of students. The RR was at least 2 in many countries and significantly greater than 1 in every country except Georgia. However, the extent of the inequity did not vary greatly across countries, with the RR results ranging from a high of 4.6 in the Slovak Republic to a low of 1.6 in Hong Kong SAR. Countries with RR’s of 4 or higher where students whose parents had less than secondary education were four times more
likely than their peers to be among the country’s poorest readers included the Slovak Republic, Israel, Iran, and Macedonia. The next group of countries with RR results of at least 3 included Hungary, Romania, England, Austria, and the Russian Federation.

The pervasiveness of the inequity associated with children being more likely than their peers to be poor readers if they have poorly educated parents presents a challenge for countries around the world. However, research has shown that there are ways for countries to tackle this problem (Abadzi, 2003). Studies of past initiatives suggest that effective adult education programs have adult education and literacy goals as a primary objective (as opposed to being a small piece of a larger program). Successful adult education programs also have intensive training and supervision programs for instructors and close attention to the organizational effectiveness and financial viability of the program. International organizations, such as the World Bank, are building on lessons learned from past efforts to develop effective adult literacy and education programs.

There has also been considerable research concerning family literacy and many countries have adult literacy projects, sometimes associated with children’s schools. For example, in PIRLS 2006, 13 percent of students internationally attended schools that offered adult literacy programs and 40 percent attended schools where education programs for parents were available, with much higher percentages in some countries (Mullis et al., 2007). Thus, parents can learn to read together with their children. There is also research showing that participating in family literacy programs can build the literacy

**RRP Equity Index Results for Students Who Did Not Speak the Language of the Test Before Starting School**

Table 4.4 presents the RRP Equity Index results for students who did not speak the language of the test before starting school. As might be anticipated based on findings from reading research as well as common sense, PIRLS 2001 and 2006 found that in many countries students who spoke the language of the test at home prior to beginning school had higher average reading achievement as fourth grade students than did their classmates who spoke another language (Mullis et al., 2007, Mullis et al., 2003). Also, it should be clarified that the PIRLS 2006 countries, if at all possible, assessed students in their language of instruction. Thus, in most cases, it can be assumed that if students did not speak the language of the test before starting school, they also did not speak the language of instruction.
Table 4.4 RRP Equity Index for Low Reading Achievement Internationally in PIRLS 2006 Countries for Fourth Grade Students Who Did Not Speak the Language of the Test Before Starting School

<table>
<thead>
<tr>
<th>Country</th>
<th>RRP Equity Index</th>
<th>Percentage of Students Below Low Benchmark</th>
<th>Percentage of Students Who Did Not Speak the Language of the Test Before School</th>
<th>RR of Low Achievement Internationally for Students Who Did Not Speak the Language of the Test Before School</th>
<th>Percentage of Students Below the 25th Percentile Nationally for Students Who Did Not Speak the Language of the Test Before School</th>
<th>RR of Low Achievement Nationally for Students Who Did Not Speak the Language of the Test Before School</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>SR 29</td>
<td>2 (0.4)</td>
<td>5 (2.3)</td>
<td>1.1 (0.0)</td>
<td>16 (1.5)</td>
<td>2.8 (0.2)</td>
</tr>
<tr>
<td>Belgium (French)</td>
<td>SR 24</td>
<td>8 (0.7)</td>
<td>8 (0.8)</td>
<td>1.1 (0.0)</td>
<td>12 (1.2)</td>
<td>2.8 (0.3)</td>
</tr>
<tr>
<td>Germany</td>
<td>SR 19</td>
<td>3 (0.3)</td>
<td>5 (0.5)</td>
<td>1.1 (0.0)</td>
<td>13 (1.7)</td>
<td>2.8 (0.3)</td>
</tr>
<tr>
<td>Sweden</td>
<td>SR 19</td>
<td>2 (0.5)</td>
<td>4 (0.5)</td>
<td>1.1 (0.0)</td>
<td>11 (1.5)</td>
<td>2.1 (0.2)</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>SR 19</td>
<td>6 (0.9)</td>
<td>4 (1.1)</td>
<td>1.1 (0.0)</td>
<td>12 (3.5)</td>
<td>2.9 (0.5)</td>
</tr>
<tr>
<td>Chinese Taipei</td>
<td>SR 18</td>
<td>3 (0.4)</td>
<td>4 (0.6)</td>
<td>1.1 (0.0)</td>
<td>11 (1.3)</td>
<td>2.1 (0.2)</td>
</tr>
<tr>
<td>England</td>
<td>SR 14</td>
<td>7 (1.0)</td>
<td>6 (0.9)</td>
<td>1.1 (0.0)</td>
<td>14 (2.2)</td>
<td>2.4 (0.3)</td>
</tr>
<tr>
<td>Norway</td>
<td>SR 10</td>
<td>8 (0.8)</td>
<td>5 (1.1)</td>
<td>1.1 (0.0)</td>
<td>9 (1.9)</td>
<td>2.0 (0.3)</td>
</tr>
<tr>
<td>Slovenia</td>
<td>SR 7</td>
<td>6 (0.5)</td>
<td>2 (0.3)</td>
<td>1.1 (0.0)</td>
<td>6 (0.8)</td>
<td>2.7 (0.3)</td>
</tr>
<tr>
<td>New Zealand</td>
<td>MR 12</td>
<td>8 (0.6)</td>
<td>5 (0.5)</td>
<td>1.1 (0.0)</td>
<td>14 (1.1)</td>
<td>1.9 (0.2)</td>
</tr>
<tr>
<td>United States</td>
<td>MR 7</td>
<td>4 (0.6)</td>
<td>6 (0.5)</td>
<td>1.1 (0.0)</td>
<td>11 (1.2)</td>
<td>1.8 (0.2)</td>
</tr>
<tr>
<td>Scotland</td>
<td>MR 7</td>
<td>7 (0.8)</td>
<td>4 (0.5)</td>
<td>1.1 (0.0)</td>
<td>7 (1.5)</td>
<td>1.8 (0.3)</td>
</tr>
<tr>
<td>Denmark</td>
<td>MR 5</td>
<td>4 (0.4)</td>
<td>4 (0.5)</td>
<td>1.1 (0.0)</td>
<td>7 (1.2)</td>
<td>1.8 (0.2)</td>
</tr>
<tr>
<td>Iran, Islamic Rep. of</td>
<td>MR 21</td>
<td>40 (1.6)</td>
<td>25 (1.8)</td>
<td>1.1 (0.0)</td>
<td>46 (3.9)</td>
<td>2.5 (0.3)</td>
</tr>
<tr>
<td>Spain</td>
<td>MR 11</td>
<td>6 (0.8)</td>
<td>13 (0.8)</td>
<td>1.1 (0.0)</td>
<td>18 (2.0)</td>
<td>1.5 (0.2)</td>
</tr>
<tr>
<td>Singapore</td>
<td>MR 11</td>
<td>3 (0.4)</td>
<td>16 (0.5)</td>
<td>1.1 (0.0)</td>
<td>22 (1.2)</td>
<td>1.5 (0.1)</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>MR 8</td>
<td>5 (1.0)</td>
<td>17 (1.7)</td>
<td>1.1 (0.0)</td>
<td>18 (3.2)</td>
<td>1.8 (0.3)</td>
</tr>
<tr>
<td>Romania</td>
<td>MR 5</td>
<td>6 (0.8)</td>
<td>6 (0.8)</td>
<td>1.1 (0.0)</td>
<td>10 (1.2)</td>
<td>1.6 (0.2)</td>
</tr>
<tr>
<td>Morocco</td>
<td>MR 4</td>
<td>7 (1.0)</td>
<td>10 (1.5)</td>
<td>1.1 (0.0)</td>
<td>9 (1.1)</td>
<td>1.6 (0.2)</td>
</tr>
<tr>
<td>Canada</td>
<td>MR 3</td>
<td>2 (0.2)</td>
<td>4 (0.2)</td>
<td>1.1 (0.0)</td>
<td>6 (0.9)</td>
<td>1.6 (0.2)</td>
</tr>
<tr>
<td>France</td>
<td>MR 3</td>
<td>4 (0.4)</td>
<td>7 (1.0)</td>
<td>1.1 (0.0)</td>
<td>6 (0.9)</td>
<td>1.6 (0.2)</td>
</tr>
<tr>
<td>South Africa</td>
<td>MR 2</td>
<td>7 (1.0)</td>
<td>10 (1.5)</td>
<td>1.1 (0.0)</td>
<td>6 (1.1)</td>
<td>1.4 (0.5)</td>
</tr>
<tr>
<td>Georgia</td>
<td>MR 1</td>
<td>7 (1.0)</td>
<td>8 (1.0)</td>
<td>1.1 (0.0)</td>
<td>6 (1.1)</td>
<td>1.4 (0.5)</td>
</tr>
<tr>
<td>Qatar</td>
<td>1</td>
<td>7 (0.7)</td>
<td>7 (0.7)</td>
<td>1.1 (0.0)</td>
<td>7 (0.7)</td>
<td>2.0 (0.1)</td>
</tr>
<tr>
<td>Macedonia, Rep. of</td>
<td>1</td>
<td>34 (1.6)</td>
<td>3 (0.6)</td>
<td>1.1 (0.0)</td>
<td>6 (1.1)</td>
<td>1.4 (0.3)</td>
</tr>
<tr>
<td>Trinidad and Tobago</td>
<td>1</td>
<td>36 (2.1)</td>
<td>31 (2.1)</td>
<td>1.1 (0.0)</td>
<td>16 (2.6)</td>
<td>1.4 (0.2)</td>
</tr>
<tr>
<td>Moldova</td>
<td>1</td>
<td>9 (0.9)</td>
<td>6 (1.0)</td>
<td>1.1 (0.0)</td>
<td>6 (1.9)</td>
<td>1.2 (0.3)</td>
</tr>
<tr>
<td>Kuwait</td>
<td>1</td>
<td>72 (1.2)</td>
<td>67 (1.2)</td>
<td>1.1 (0.0)</td>
<td>45 (3.2)</td>
<td>0.8 (0.1)</td>
</tr>
<tr>
<td>Belgium (Flemish)</td>
<td>1</td>
<td>46 (2.1)</td>
<td>33 (2.1)</td>
<td>1.1 (0.0)</td>
<td>23 (3.0)</td>
<td>1.0 (0.1)</td>
</tr>
<tr>
<td>Hong Kong SAR</td>
<td>1</td>
<td>1 (0.2)</td>
<td>4 (0.3)</td>
<td>1.1 (0.0)</td>
<td>12 (1.8)</td>
<td>1.8 (0.2)</td>
</tr>
<tr>
<td>Hungary</td>
<td>1</td>
<td>3 (0.5)</td>
<td>2 (0.5)</td>
<td>1.1 (0.0)</td>
<td>1 (0.2)</td>
<td>1.2 (0.3)</td>
</tr>
<tr>
<td>Italy</td>
<td>1</td>
<td>2 (0.4)</td>
<td>3 (0.5)</td>
<td>1.1 (0.0)</td>
<td>5 (0.9)</td>
<td>1.6 (0.3)</td>
</tr>
<tr>
<td>Latvia</td>
<td>1</td>
<td>2 (0.4)</td>
<td>4 (0.4)</td>
<td>1.1 (0.0)</td>
<td>4 (0.9)</td>
<td>2.3 (0.4)</td>
</tr>
<tr>
<td>Lithuania</td>
<td>1</td>
<td>3 (0.6)</td>
<td>2 (0.5)</td>
<td>1.1 (0.0)</td>
<td>3 (0.6)</td>
<td>1.6 (0.3)</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>1</td>
<td>7 (0.7)</td>
<td>6 (0.7)</td>
<td>1.1 (0.0)</td>
<td>7 (0.7)</td>
<td>1.6 (0.1)</td>
</tr>
<tr>
<td>Netherlands</td>
<td>1</td>
<td>1 (0.3)</td>
<td>3 (0.6)</td>
<td>1.1 (0.0)</td>
<td>5 (1.2)</td>
<td>1.9 (0.3)</td>
</tr>
<tr>
<td>Poland</td>
<td>1</td>
<td>7 (0.7)</td>
<td>1 (0.2)</td>
<td>1.1 (0.0)</td>
<td>1 (0.2)</td>
<td>1.6 (0.4)</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>1</td>
<td>2 (0.5)</td>
<td>6 (1.0)</td>
<td>1.1 (0.0)</td>
<td>11 (2.0)</td>
<td>1.9 (0.4)</td>
</tr>
</tbody>
</table>

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A7 of PIRLS 2006 International Report).
‡ Nearly satisfying guidelines for sample participation rates after replacement schools were included (see Exhibit A7 of PIRLS 2006 International Report).
‡‡ National Defined Population covers less than 95% of National Desired Population (see Exhibit A4 of PIRLS 2006 International Report).
2a National Defined Population covers less than 80% of National Desired Population (see Exhibit A4 of PIRLS 2006 International Report).
†† Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
§ Indicates data not available
* Indicates insufficient data to report results
** Severe GRR (Relative Risk Ratio >=3) and High Percentage of Students in 'At Risk' Group (>50)
††† Moderate GRR (Relative Risk Ratio 2-3) and High Percentage of Students in 'At Risk' Group (>50)
The percentage of students who did not speak the language of the test before starting school (third column) varied considerably from country to country. Although many countries had less than 10 percent of their students in the ‘at risk’ category, the underlying causes of differences between students’ mother tongue and the language of testing vary dramatically from centuries of cultural heritage to yesterday’s wave of immigration. Thus, the possibilities for addressing inequities related to minority language students also vary depending on the country, including the cultural situation and the learning situation, as well as the type and amount of resources required.

In the chapters written for the *PIRLS 2006 Encyclopedia* (Kennedy et al., 2007), each country provided information about the official languages spoken in the country and the policies concerning the language of instruction for fourth grade students. For example, Luxembourg had the largest percentage of students (67%) who did not speak the language of the test before starting school, because students speak Luxembourgish at home and during the initial years of schooling. In the third grade, they begin instruction in German and were tested in German for PIRLS (at the fifth grade). Kuwait had the next largest percentage (51%) of students in this ‘at risk’ group because formal written Arabic, the language of the test, is not a language used in daily communication. So, typically students do not begin instruction in formal Arabic until they begin school, and are still learning in the process of learning the written language in the fourth grade. Students in Singapore were tested in English, a language that 16 percent had not encountered at home prior to entering school. However, in Singapore it is expected that students do not speak
the language of instruction as their mother tongue, and there is support provided in schools for the development of students’ home language in addition to English.

Another group of PIRLS 2006 countries were originally settled by or have evolved to include groups with different cultural heritages (sometimes residing in different regions of the country) that have historically spoken different languages, such as Canada, Hong Kong SAR, Indonesia, Iran, Latvia, Morocco, South Africa, and Spain. In several of these countries, the assessment was conducted in different languages in an attempt to have the language of the assessment correspond to students’ language of instruction, including 8 languages in Spain and 11 languages in South Africa.

Another prevalent reason for students not having spoken the language of the test before starting school is that their families have emigrated from another country, and nearly all of the PIRLS 2006 countries had experienced some degree of immigration. The percentage of immigrants varied widely across countries, and could have been essentially from one region of the world or many regions. Also, the degree of immigration was independent of the historical language situation. A country may have had one predominant language, such as Swedish, and experienced immigration. Or a country that had a history involving two or more major languages also could have experienced a substantial influx of immigrants from all over the world; for example, Canada.

Table 4.4 shows 13 shaded countries, indicating that students who did not speak the language of the test before starting school were at least twice as likely as their classmates to be below the PIRLS 2006 Low International Benchmark. Nine countries
were in the SR category, including Austria, the French speaking part of Belgium, Germany, Sweden, the Slovak Republic, Chinese Taipei, England, Norway, and Slovenia. The relative risk ratios for these fourth grade students ranged from 3 through 5.5. The remaining four shaded countries were in the MR category (RRs of 2 up to 3), including New Zealand, the United States, Scotland, and Denmark.

Interestingly, all 13 shaded countries: 1) were relatively high achieving countries in PIRLS 2006 with 8 percent or less of their students achieving below the PIRLS 2006 Low International Benchmark, 2) had 8 percent or less of their students in the ‘at risk’ group, and 3) reported having one official or predominant national language. For example, New Zealand considers Maori an official language but only about 3 percent of the student population is educated in Maori (Chamberlain, 2007). The PIRLS 2006 results together with the information provided by countries in the PIRLS 2006 Encyclopedia suggest that for these 13 countries the overrepresentation among low reading achievers of students who did not speak the language of the test before starting school may be associated with various language minority groups, often the result of immigration from other countries.

The highest RRP Equity Index value (29) was in Austria, which had 7 percent of its students in the ‘at risk’ group, and they were five times more likely than their classmates to have reading skills below the PIRLS 2006 Low International Benchmark. The 4 percent of ‘at risk’ students in the Slovak Republic also were five times more likely
than their classmates to have extremely poor reading skills (although this statistic had a relatively large standard error and was not significant).

Besides the 13 shaded countries, the relative risk ratio was significantly greater than one in an additional 10 countries. Among these countries, although Iran missed the cutoff for the MR categorization, it had a relatively high RRP Equity Index value (21) for this ‘at risk’ group and has a very different pattern from the 13 countries in the MR or SR categories. Compared to those countries, Iran had a substantially greater percentage of students (25%) who did not speak the language of the test before starting school and a somewhat lower RR of 1.8. Instead of Farsi, the language of instruction, these students may speak Turkish or Kurdish, which are spoken by 26 and 9 percent of the population, respectively (Karimi & Bakhshalizadeh, 2007). Some research suggests that these students may largely be from particular regions of Iran with large proportions of Turkish-speaking people (Hameedy, 2004). In the largest of these Turkish-speaking regions, it has been reported that only 41 percent of the population can speak Farsi.

Looking at the results for the students below the 20th percentile of reading achievement within each country, the RR for students who did not speak the language of the test before starting school being more likely than their peers to be among a country’s lowest readers was significantly greater than one in most of the countries. However, these relative risk ratios were generally moderate, ranging from 1.4 to 2.9. In general, the results for the lowest 20 percent of students reflect the findings from analyses of the students below the PIRLS 2006 Low International Benchmark.
Overall, several major patterns emerge from the RRP Equity Index data in Table 4.4. A number of PIRLS countries have multiple language groups as a result of their history and culture and these countries had lower degrees of inequities for students who did not speak the language of the test before starting school than did some of the higher performing PIRLS 2006 countries with one official or predominant language.

In some of the multilingual countries, for example, Spain, Canada, Hong Kong SAR, and South Africa, national educational policies include providing fourth grade students instruction in their native language (sometimes in conjunction with another official national language) and, then, also assessing them in their native language. Generally, in these countries, there were significant but relatively moderate inequities associated with the ‘at risk’ group being overrepresented among low reading achievers. These countries are experienced in bilingual and second language instruction, and all students may benefit from this multilingual learning environment. An example of this can be found in Spain, where Catalan and Castilian Spanish are taught in some areas using language maintenance bilingual education, the goal of which is to promote both languages and their development in students (Baker & Jones, 1998).

In some other countries with a heritage of multiple languages, students begin instruction in a predominant language that differs from their mother tongue when they start school. In these countries, for example, Singapore or Luxembourg, larger percentages of students are impacted by needing to learn a new language, but while significant inequities are associated with this situation they also are moderate. The
educational systems in these countries may be prepared and organized to provide second language instruction to these students, because there is such a large proportion of them. In Singapore, for example, courses in most mother tongue languages are offered through secondary school (Singapore Ministry of Education, 2007).

The difficulties appear greatest for students who do not speak the language of the test before starting school where testing occurs in the one official or predominant national language, which is also the language of instruction. That is, some students do not speak the language of instruction when they begin school, and because instruction is almost exclusively in English, or German, or Norwegian, for example, there is no readily available provision by the school to address the situation.

Research about how to assist such language minority students suggests that there are several ways they can be supported and empowered in their literacy development (Baker & Jones, 1998). These methods include incorporating the language minority students’ home language and culture into the school curriculum and encouraging the minority community to participate in their children’s education. These efforts make it clear that the minority language group is valued and are viewed as more beneficial than approaches that immerse children in the majority language at the expense of their mother tongue. However, such efforts require considerable resources and are certainly more difficult to implement in countries where a small percentage of students do not speak the language of the test that may come from a range of language backgrounds. This is the case in Austria, for example, where the overwhelming majority (98 percent) of residents
speak German, but several minority languages comprise the remaining 2 percent of the population (Baker & Jones, 1998, p. 399).

**RRP Equity Index Results for Students Who Did Not Always Speak the Language of the Test at Home**

Table 4.5 presents the RRP Equity Index results for students who reported that they did not always speak the language of the test at home. In PIRLS 2001 and 2006, the relationship between speaking a second language at home and reading achievement varied substantially across countries (Mullis et al., 2007; Mullis et al., 2003). While students who always spoke the language of the test had higher achievement on average internationally, there were several multilingual countries (e.g., Hong Kong SAR, South Africa) where fourth grade students who sometimes spoke a different language at home had the highest PIRLS scores.
<table>
<thead>
<tr>
<th>Country</th>
<th>RRP Equity Index</th>
<th>Percentage of Students Below Low Benchmark</th>
<th>Percentage of Students Who Do Not Always Speak the Language of the Test at Home</th>
<th>RR of Low Achievement Internationally for Students Who Do Not Always Speak the Language of the Test at Home</th>
<th>Percentage of Students Who Do Not Always Speak the Language of the Test at Home</th>
<th>RR of Low Achievement Nationally for Students Who Do Not Always Speak the Language of the Test at Home</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>SI</td>
<td>10</td>
<td>2.0 (0.4)</td>
<td>26 (1.3)</td>
<td>63 (6.1)</td>
<td>4.8 (1.3)</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>MR</td>
<td>43</td>
<td>6 (0.9)</td>
<td>29 (1.6)</td>
<td>50 (7.1)</td>
<td>2.5 (0.4)</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>MR</td>
<td>37</td>
<td>5 (1.0)</td>
<td>38 (2.2)</td>
<td>49 (5.8)</td>
<td>2.2 (0.5)</td>
</tr>
<tr>
<td>Germany</td>
<td>MR</td>
<td>35</td>
<td>3 (0.3)</td>
<td>27 (1.0)</td>
<td>45 (9.7)</td>
<td>2.3 (1.0)</td>
</tr>
<tr>
<td><strong>Iran, Islamic Rep.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Belgium (Flemish)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>United States</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Israel</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Russian Federation</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Georgia</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Canada</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Iceland</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Trinidad and Tobago</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Georgia</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Qatar</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.7 of PIRLS 2006 International Report).
‡ Nearly satisfying guidelines for sample participation rates after replacement schools were included (see Exhibit A.7 of PIRLS 2006 International Report).
1 Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
* Indicates data not available
Indicates insufficient data to report results
■ Severe GRR (Relative Risk Ratio >3) and High Percentage of Students in ‘At Risk’ Group (>= 50)
‡ Indicates risk significantly greater than 1
† Indicates risk significantly less than 1

Table 4.5 RRP Equity Index for Low Reading Achievement Internationally in PIRLS 2006 Countries for Fourth Grade Students Who Do Not Always Speak the Language of the Test at Home.

MR = Moderate Risk (Relative Risk Ratio =2 and <3 and High Percentage of Students in ‘At Risk’ Group (>=2 and <3))
The percentage of students who did not always speak the language of the test at home fluctuated from country to country. As the third column of Table 4.5 shows, the size of this ‘at risk’ group ranged from 15 percent in Georgia to nearly all students (97%) in Luxembourg. Similar to patterns found in the previous exhibit, which focused on students who did not speak the language of the test before starting school, countries with one dominant language, such as Denmark and Norway (19-20%), tended to have fewer students in this ‘at risk’ category than countries with multiple prominent languages, such as Luxembourg, Singapore, and Kuwait (74-97%). In many of these multilingual countries, it seems logical that a large proportion of students would speak a language different from the one used in school because instruction is usually not provided in students’ mother tongue.

There were four countries where students with this characteristic were at Severe or Moderate Risk of performing below the Low International Benchmark (Austria, the Slovak Republic, Bulgaria, and Germany), meaning that these student were at least twice as likely to have low reading achievement as students who always spoke the language of the test at home. Within each of these countries, roughly one quarter (25-30%) of fourth grade students were in the ‘at risk’ group. When this is compared to data in the fourth column of Table 4.5, the percentage of students below the Low Benchmark who were in the ‘at risk’ group, the gap between the values in these two columns makes it clear that fourth grade students who speak another language at home were disproportionately represented among low reading achievers, indicating inequity. In the three countries in
the MR category (the Slovak Republic, Bulgaria, and Germany), students with this risk factor comprised around half of the students below the PIRLS 2006 Low International Benchmark. This resulted in relative risk ratios between 2.2 and 2.5, though results in Germany were not statistically significant.

In Austria, which was the only country with a RR greater than 3, students who did not always speak the language of the test at home made up 63 percent of those with poor reading skills, resulting in a RR of 4.8 and an RRP value (101) more than double that found in any other country. Austria also had the highest RRP value for students who did not speak the language of the test before starting school (shown in Table 4.4), demonstrating the close relationship between these two risk factors for low reading achievement.

In the countries where students who did not always speak the language of the test at home were at least twice as likely as other students to have low reading achievement, there tended to be one language dominantly used in education. This was also the case in the five other countries with RR values significantly greater than 1 for this ‘at risk’ group, including Iran, the French speaking part of Belgium, England, New Zealand, and Norway. Of the eight countries with significant relative risk ratios, only three administered the PIRLS 2006 assessment in more than one language (the Slovak Republic, New Zealand, and Norway). In each of these countries the second language of administration was intended for a small minority group. In the Slovak Republic, for example, most students are educated in Slovak but there are some regions where
instruction is provided in a minority language, primarily Hungarian (Lukackova & Obrancova, 2007). Therefore, a Hungarian version of the assessment was provided in these regions.

Some of the countries with inequity in reading outcomes for this ‘at risk’ group, indicated by significant RR values, also had substantial numbers of immigrants who may come to school with a diverse set of language needs. In England, for example, the percentage of students who speak a language other than English at home is on the rise, reaching 39 percent in London (Twist, 2007). These students often speak one of several South Asian languages, and are integrated into mainstream schools with instruction primarily in English.

Signifying the culturally-specific role of language in education, there were also eight countries where fourth grade students who did not always speak the language of the test at home were less likely to have low reading achievement than their classmates who always spoke the language of the test. These countries included Chinese Taipei, Indonesia, Israel, Kuwait, Macedonia, Moldova, Qatar, and South Africa. In many of these countries, a substantial percentage of the student population spoke a second language and multiple languages were often a part of the culture and education system. In Indonesia, for example, while instruction is provided in Indonesian, there were 62 percent of students who speak another language at home. This is likely because many children come to school speaking one of the hundreds of regional languages and are expected to learn Indonesian as part of formal education (Tola, 2007).
Focusing on the RR results as an equity indicator using the national 20th percentile as the threshold for low reading achievement, fourth grade students who did not always speak the language of the test at home had a significantly greater risk of low reading achievement in 18 of the PIRLS countries. In general, the level of risk in these countries was fairly moderate, ranging from 1.2 in Canada to 2.4 in Germany. There were also eight countries where multilingual students had an RR significantly less than 1, consistent with the patterns seen for the Low International Benchmark.

Overall, the patterns that emerged from this exhibit follow the trends seen in Table 4.4, which examined the risk for students who did not speak the language of the test before starting school. While the role of a second language is country-specific, countries that have one dominant language and a relatively small proportion of students who speak a language other than the one used in school when they are at home tended to have less equity in reading outcomes for these ‘at risk’ students. In many of these countries, there were small language minority groups or recent waves of immigration, potentially resulting in a small group of students with diverse language needs.

In contrast, countries that use multiple languages in school and society with higher percentages of students using a second language at home tended to have low levels of risk for these students. In many cases, students who used a second language at home benefited from this characteristic and were less likely to be lack basic reading skills than their monolingual classmates.
RRP Equity Index Results for Students Attending Rural Schools

Table 4.6 presents the RRP Equity Index results for students attending rural schools. A key component of the PIRLS 2006 Framework is the important role that the community that students and their families are a part of can play in their literacy development (Mullis et al., 2004). Different communities within a country may have differing levels of resources or even varying education policies, both of which can impact reading development. In PIRLS 2006, achievement was analyzed across countries for the three types of communities—rural, urban, and suburban. On average across countries, among the three community types students attending schools in rural areas had the lowest reading achievement—25 points (one quarter of a standard deviation) lower than students in urban schools (Mullis et al., 2007), and similar achievement gaps have been found in other cross-national studies of reading (UNESCO, 2008). However, this relationship was not consistent internationally, and the community types with the lowest achievement varied from country to country.

As one would expect given the diverse group of countries that participated in PIRLS 2006, the third column of Table 4.6 shows that the proportion of students attending rural schools varied substantially across countries. While only three percent of students in Qatar attended rural schools, nearly three-fourths of the fourth grade students in Indonesia did.
Table 4.6 RRP Equity Index for Low Reading Achievement Internationally in PIRLS 2006 Countries for Fourth Grade Students Attending Rural Schools

<table>
<thead>
<tr>
<th>Country</th>
<th>RRP Equity Index</th>
<th>Percentage of Students Below Low Benchmark</th>
<th>Percentage of Students Attending Rural Schools</th>
<th>Percentage of Students Below Low Achievement Internationally for Students Attending Rural Schools</th>
<th>Percentage of Students Below the 25th Percentile Nationally for Students Attending Rural Schools</th>
<th>RRP of Low Achievement Nationally for Students Attending Rural Schools</th>
<th>Category</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slovak Republic</td>
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<td>40 (3.3)</td>
<td>66 (7.9)</td>
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<td>55 (4.9)</td>
<td>§</td>
<td>3</td>
</tr>
<tr>
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<td>33 (6.8)</td>
<td>60 (9.0)</td>
<td>3.0 (0.8)</td>
<td>MR</td>
<td>3</td>
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<tr>
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<td>MR</td>
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<td>70 (5.3)</td>
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<td>-</td>
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<td>MR</td>
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<td>2.8 (1.0)</td>
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<td>31 (2.6)</td>
<td>48 (4.7)</td>
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<td>84 (2.7)</td>
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<td>76 (4.7)</td>
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<td>1.8 (0.3)</td>
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<td>-</td>
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</tr>
</tbody>
</table>

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.7 of PIRLS 2006 International Report).
‡ Nearly satisfying guidelines for sample participation rates after replacement schools were included (see Exhibit A.7 of PIRLS 2006 International Report).
2a National Defined Population covers less than 95% of National Desired Population (see Exhibit A.4 of PIRLS 2006 International Report).
3a National Defined Population covers less than 80% of National Desired Population (see Exhibit A.4 of PIRLS 2006 International Report).
†† Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
* Indicates data not available
††† Indicates insufficient data to report results
■ Severe GRR (Relative Risk Ratio =>3 for students in this country performing below Low Benchmark, as compared to other PIRLS countries)
‡ Moderate GRR (Relative Risk Ratio >=2 and < 3 for students in this country performing below Low Benchmark, as compared to other PIRLS countries)
Seven countries are shaded in this exhibit, indicating that students in these countries attending rural schools had a Moderate or Severe Risk of lacking basic reading skills relative to their peers. Fourth grade rural students in the Slovak Republic and Israel were three times as likely as students in other schools to be very low reading achievers, placing them in the SR category. Rural students in Romania, Bulgaria, Iran, Hungary, and Macedonia were in the MR category (though the RR values in Bulgaria and Hungary were not statistically significant), meaning they were at least twice as likely as their peers to be in danger of illiteracy. Substantial numbers of students were in danger of this inequity in each of these shaded countries—at least 25 percent of fourth grade students were learning in rural communities, reaching nearly half (48 percent) in Romania.

The highest RRP Equity Index value (78) for this risk factor was in the Slovak Republic, where 40 percent of students attended rural schools and they were three times as likely as their peers to lack the reading skills at the Low International Benchmark. Romania followed closely behind the Slovak Republic, with an RRP Equity Index value of 74. Though the RR value (2.6) in Romania was below the cutpoint required for the SR category, the large percentage (48) of students in the ‘at risk’ group resulted in a substantial RRP value.

There was an RR value significantly greater than 1 for rural students in 13 of the PIRLS countries, though the level of risk in eight of these countries was fairly small (below 2). Despite being below the RR cutoff for inclusion in the MR category, several countries had RRP Equity Index values equal to or higher than countries that were in the
Moderate Risk category. These countries included Indonesia (RRP = 58), Moldova (RRP = 47), and Poland (RRP = 33). In each of these countries, the relatively high RRP Equity Index values were the result of large percentages of students attending rural schools, in conjunction with RR values close to 2. Indonesia stands out in particular with a higher percentage (78) of rural students than any other country.

In countries where rural students are disadvantaged, it is often due to a lack of human and material resources and a lack of reinforcement for education (Lockheed & Verspoor, 1991). These types of educational support are often lacking in rural regions of developing countries. All but one of the countries (Israel) where rural students had a significant risk of low achievement compared to their peers were categorized as having an emerging or developing economy by the International Monetary Fund (IMF, 2008), a classification made based on Gross Domestic Product (GDP) and export earnings, among other economic indicators.

Focusing on the national threshold of low reading achievement, the national 20th percentile, trends generally followed those found when the Low International Benchmark was used. Rural students were significantly more likely than urban or suburban students to be at the bottom of their country’s achievement distribution in 21 of the PIRLS countries. Included in this group were several countries for which results were not produced for the Low International Benchmark because so few students (less than two percent) scored below the threshold, including Italy, Latvia, Lithuania, and the Russian Federation. Though the RR results were moderate in most cases, rural students in eight
countries had at least twice the likelihood of having reading scores in the bottom 20 percent of their country’s distribution compared to their peers.

South Africa had one of the highest RR values (2.6) for the national threshold of low reading achievement, which is substantially higher than the South African RR value (1.5) for the Low International Benchmark, though both were statistically significant. This variation highlights the difference between the two thresholds of low reading achievement that were used in this dissertation. In South Africa, most students (78 percent) scored below the Low International Benchmark. While it is useful to examine which students are most likely to fall below this point because the Low International Benchmark is associated with a series of foundational reading skills, it does not highlight the students who are most in need of assistance in the South African context. For this purpose, the national 20th percentile may be more useful.

**RRP Equity Index Results for Students Attending Urban Schools**

While rural students are more disadvantaged and at greater risk of low reading achievement than those in urban or suburban areas in many parts of the world, this differs from country to country. In some countries, students in large, urban centers tend to be disproportionately underprivileged. Consistent with this idea, recent research focusing on countries with high Gross National Product (GNP) using PIRLS 2006 data has found lower PIRLS scores in urban areas than in suburban or rural areas, and that school location was an important factor in reading achievement (van Diepen, Verhoeven, & Aarnoutse, 2008). Throughout the 20th century and carrying into the 21st, urban areas
around the world have attracted people hoping for better opportunities, many of whom are emigrating from another country (Coulby, Jones, & Harris, 1992). As a result of these immigration trends, particularly in more developed countries, large cities have become “linguistically, racially, religiously and culturally diverse, with the educational systems of those cities often being unwilling or incapable of adjusting to changed and still changing circumstances” (p. 9).

Table 4.7 presents the RRP Equity Index results for fourth grade students attending urban schools in the PIRLS 2006 countries. The few shaded countries indicate that, by and large, there was little inequity associated with this student characteristic in most PIRLS countries. However, for the several countries where urban students were at risk of low reading achievement compared to rural or suburban students, the level of inequity was substantial.
Table 4.7 RRP Equity Index for Low Reading Achievement Internationally in PIRLS 2006 Countries for Fourth Grade Students Attending Urban Schools

<table>
<thead>
<tr>
<th>Country</th>
<th>RRP Equity Index</th>
<th>Percentage of Students Below Low Benchmark</th>
<th>Percentage of Students Attending Urban Schools</th>
<th>RR of Low Achievement Internationally for Students Attending Urban Schools</th>
<th>Percentage of Students Below the 20th Percentile Nationally Attending Urban Schools</th>
<th>RR of Low Achievement Nationally for Students Attending Urban Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>SI</td>
<td>219</td>
<td>3 (1.3)</td>
<td>37 (1.3)</td>
<td>7 (1.0)</td>
<td>46 (4.4)</td>
</tr>
<tr>
<td>英格兰</td>
<td>MR</td>
<td>79</td>
<td>7 (1.0)</td>
<td>46 (4.4)</td>
<td>70 (6.5)</td>
<td>2.7 (0.8)</td>
</tr>
<tr>
<td>奥地利</td>
<td>MR</td>
<td>36</td>
<td>2 (0.4)</td>
<td>31 (3.4)</td>
<td>49 (6.9)</td>
<td>2.1 (0.5)</td>
</tr>
<tr>
<td>比利时 (法语)</td>
<td></td>
<td>29</td>
<td>8 (0.7)</td>
<td>47 (4.0)</td>
<td>59 (7.1)</td>
<td>1.6 (0.4)</td>
</tr>
<tr>
<td>苏格兰</td>
<td></td>
<td>20</td>
<td>7 (0.8)</td>
<td>32 (3.9)</td>
<td>43 (7.5)</td>
<td>1.6 (0.4)</td>
</tr>
<tr>
<td>加拿大</td>
<td></td>
<td>19</td>
<td>2 (0.2)</td>
<td>48 (2.9)</td>
<td>56 (4.9)</td>
<td>1.4 (0.2)</td>
</tr>
<tr>
<td>美国</td>
<td></td>
<td>12</td>
<td>4 (0.6)</td>
<td>28 (3.5)</td>
<td>35 (6.1)</td>
<td>1.4 (0.3)</td>
</tr>
<tr>
<td>德国</td>
<td></td>
<td>5</td>
<td>4 (0.4)</td>
<td>33 (4.0)</td>
<td>36 (7.8)</td>
<td>1.1 (0.3)</td>
</tr>
<tr>
<td>丹麦</td>
<td></td>
<td>3</td>
<td>2 (0.5)</td>
<td>27 (4.1)</td>
<td>29 (8.3)</td>
<td>1.1 (0.4)</td>
</tr>
<tr>
<td>瑞典</td>
<td></td>
<td>4</td>
<td>0 (0.4)</td>
<td>34 (4.0)</td>
<td>34 (7.5)</td>
<td>1.0 (0.3)</td>
</tr>
<tr>
<td>法国</td>
<td></td>
<td>3</td>
<td>0 (0.4)</td>
<td>34 (4.0)</td>
<td>34 (7.5)</td>
<td>1.0 (0.3)</td>
</tr>
<tr>
<td>挪威</td>
<td></td>
<td>8</td>
<td>0 (0.8)</td>
<td>30 (3.6)</td>
<td>18 (4.0)</td>
<td>0.9 (0.2)</td>
</tr>
<tr>
<td>新西兰</td>
<td></td>
<td>8</td>
<td>0 (0.6)</td>
<td>40 (3.2)</td>
<td>38 (5.2)</td>
<td>0.9 (0.2)</td>
</tr>
<tr>
<td>南非</td>
<td></td>
<td>6</td>
<td>0 (0.5)</td>
<td>36 (4.2)</td>
<td>34 (5.9)</td>
<td>0.9 (0.2)</td>
</tr>
<tr>
<td>科威特</td>
<td></td>
<td>73</td>
<td>12 (1.2)</td>
<td>26 (3.6)</td>
<td>23 (3.6)</td>
<td>0.9 (0.0)</td>
</tr>
<tr>
<td>印度尼西亚</td>
<td></td>
<td>46</td>
<td>2 (1.1)</td>
<td>12 (2.2)</td>
<td>6 (1.7)</td>
<td>0.5 (0.1)</td>
</tr>
<tr>
<td>多哥</td>
<td></td>
<td>36</td>
<td>2 (1.1)</td>
<td>19 (2.6)</td>
<td>13 (3.2)</td>
<td>0.6 (0.1)</td>
</tr>
<tr>
<td>摩洛哥</td>
<td></td>
<td>74</td>
<td>2 (0.4)</td>
<td>37 (3.3)</td>
<td>32 (3.4)</td>
<td>0.8 (0.0)</td>
</tr>
<tr>
<td>冰岛</td>
<td></td>
<td>7</td>
<td>0 (0.8)</td>
<td>34 (4.0)</td>
<td>27 (3.1)</td>
<td>0.7 (0.1)</td>
</tr>
<tr>
<td>卡塔尔</td>
<td></td>
<td>67</td>
<td>0 (0.7)</td>
<td>65 (0.3)</td>
<td>61 (0.5)</td>
<td>0.9 (0.0)</td>
</tr>
<tr>
<td>匈牙利</td>
<td></td>
<td>3</td>
<td>0 (0.3)</td>
<td>28 (2.2)</td>
<td>17 (8.8)</td>
<td>0.5 (0.3)</td>
</tr>
<tr>
<td>摩尔多瓦</td>
<td></td>
<td>9</td>
<td>9 (0.9)</td>
<td>29 (2.4)</td>
<td>17 (3.4)</td>
<td>0.5 (0.1)</td>
</tr>
<tr>
<td>乔治亚</td>
<td></td>
<td>18</td>
<td>3 (1.3)</td>
<td>42 (3.6)</td>
<td>28 (4.0)</td>
<td>0.5 (0.1)</td>
</tr>
<tr>
<td>波兰</td>
<td></td>
<td>7</td>
<td>5 (0.7)</td>
<td>52 (2.1)</td>
<td>40 (4.4)</td>
<td>0.6 (0.1)</td>
</tr>
<tr>
<td>伊朗,伊斯兰共和国</td>
<td></td>
<td>40</td>
<td>16 (1.6)</td>
<td>50 (2.9)</td>
<td>32 (3.4)</td>
<td>0.5 (0.0)</td>
</tr>
<tr>
<td>马其顿,共和国</td>
<td></td>
<td>34</td>
<td>16 (1.6)</td>
<td>51 (3.7)</td>
<td>33 (4.0)</td>
<td>0.5 (0.1)</td>
</tr>
<tr>
<td>罗马尼亚</td>
<td></td>
<td>16</td>
<td>16 (1.8)</td>
<td>47 (2.2)</td>
<td>26 (5.0)</td>
<td>0.4 (0.1)</td>
</tr>
<tr>
<td>西班牙</td>
<td></td>
<td>6</td>
<td>6 (0.8)</td>
<td>58 (4.3)</td>
<td>41 (7.7)</td>
<td>0.5 (0.1)</td>
</tr>
<tr>
<td>以色列</td>
<td></td>
<td>15</td>
<td>12 (1.2)</td>
<td>49 (3.9)</td>
<td>26 (6.4)</td>
<td>0.4 (0.1)</td>
</tr>
<tr>
<td>斯洛伐克</td>
<td></td>
<td>6</td>
<td>6 (0.9)</td>
<td>52 (3.0)</td>
<td>30 (3.7)</td>
<td>0.4 (0.1)</td>
</tr>
<tr>
<td>保加利亚</td>
<td></td>
<td>5</td>
<td>5 (1.0)</td>
<td>70 (3.0)</td>
<td>49 (5.5)</td>
<td>0.4 (0.1)</td>
</tr>
<tr>
<td>比利时 (弗拉芒)</td>
<td></td>
<td>1</td>
<td>1 (0.2)</td>
<td>37 (3.6)</td>
<td>27 (3.6)</td>
<td>0.2 (0.0)</td>
</tr>
<tr>
<td>香港 SAR</td>
<td></td>
<td>1</td>
<td>1 (0.2)</td>
<td>37 (3.6)</td>
<td>29 (3.6)</td>
<td>0.2 (0.0)</td>
</tr>
<tr>
<td>意大利</td>
<td></td>
<td>2</td>
<td>2 (0.4)</td>
<td>70 (3.6)</td>
<td>40 (5.3)</td>
<td>0.2 (0.0)</td>
</tr>
<tr>
<td>拉脱维亚</td>
<td></td>
<td>1</td>
<td>1 (0.3)</td>
<td>72 (2.3)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>立陶宛</td>
<td></td>
<td>1</td>
<td>1 (0.3)</td>
<td>72 (2.3)</td>
<td>63 (2.0)</td>
<td>-</td>
</tr>
<tr>
<td>荷兰</td>
<td></td>
<td>1</td>
<td>1 (0.3)</td>
<td>72 (2.3)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>卢森堡</td>
<td></td>
<td>2</td>
<td>2 (0.5)</td>
<td>63 (2.0)</td>
<td>63 (2.0)</td>
<td>-</td>
</tr>
<tr>
<td>新加坡</td>
<td></td>
<td>3</td>
<td>3 (0.4)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.7 of PIRLS 2006 International Report).

‡ Nearly satisfying guidelines for sample participation rates after replacement schools were included (see Exhibit A.7 of PIRLS 2006 International Report).

§ National Defined Population covers less than 95% of National Desired Population (see Exhibit A.4 of PIRLS 2006 International Report).

¶ National Defined Population covers less than 80% of National Desired Population (see Exhibit A.4 of PIRLS 2006 International Report).

†† Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

 indication data not available

indicates insufficient data to report results

Severe GRR (Relative Risk Ratio > 3) and High Percentage of Students in 'At Risk' Group (>= 50)

Medium GRR (Relative Risk Ratio = 2 and < 3) and High Percentage of Students in 'At Risk' Group (>= 50)

Moderate GRR (Relative Risk Ratio >= 2 and < 3 for students in this country performing below Low Benchmark, as compared to other PIRLS countries)

Marginal GRR (Relative Risk Ratio >= 1 and < 2 for students in this country performing below Low Benchmark, as compared to other PIRLS countries)
Urban students were at least twice as likely as other students to score below the PIRLS 2006 Low International Benchmark in three of the PIRLS countries—Germany, England, and Austria. These were also the only three countries with RR values significantly greater than one. There are several similarities across these countries. First, they all have high reading achievement on average, with few students (7% or less) lacking the skills associated with the Low International Benchmark. In addition, each of these countries also had a considerable number (30-50%) of students attending urban schools. Contextually, there is also a pattern, as all of these countries are located in Western Europe, highly developed, and have one primary language. However, the level of inequity in reading outcomes for urban students varied within this group.

Germany is highlighted as the only country in the Severe Risk category and has an extreme RRP value (219)—more than double the value in any other country. Looking across the columns in Table 4.7, the third column shows that more than one-third (37%) of German students attended urban schools. When the focus is narrowed to only those students below the Low International Benchmark (column 4), this number doubles to 79 percent—indicating that most fourth grade students with low reading achievement attend school in urban areas. This disparity results in a RR value of 6.9, meaning that urban students were nearly seven times as likely as rural or suburban students to lack the basic literacy skills associated with the Low International Benchmark. This value is far above the relative risk ratio of 3 required for inclusion in the SR category.
These results may be explained by the fact that urban schools in Germany have large numbers of immigrant students, comprising 80 percent of some inner-city classes (Hornberg, Bos, Lankes, Valtin, 2007). Many of these students are recent immigrants, and may speak a range of languages, including Italian, Greek, Spanish, Portuguese, Russian, Turkish, and Polish. These new immigrants speak little German and are often low achievers in school (Schwippert, 2007).

Urban students in England and Austria, the two countries in the MR category, had much lower levels of risk than those found in Germany. While the RRs were still substantial (2.7 and 2.1, respectively), they were less than half of the German RR value. This disparity in results seems unusual given the many similarities of these three countries. However, other research has also found that immigrant students in Germany (many of which attend urban schools) not only have low performance in reading, but that their performance is lower than that of comparative immigrant groups in other countries (Mannitz, 2004).

Broadening the examination of Table 4.7 to include the large number of non-shaded countries, there are high percentages of urban students in most of the PIRLS 2006 countries. Several of the countries with the highest percentages of urban students also had the fewest students below the Low International Benchmark, including the Russian Federation, Italy, Latvia, and Lithuania. These countries each had more than 60 percent of their students in urban schools.
Results using the national 20th percentile as the threshold of low reading achievement were similar to those for the Low International Benchmark. In the majority (24) of the PIRLS 2006 countries, urban students were significantly less likely than rural or suburban students to score at the bottom of their country’s achievement distribution. Urban students in six countries had a significantly greater risk than their peers of being in the bottom 20 percent of the country’s reading achievement distribution. The level of risk in these countries was fairly low, with a maximum RR value of 2.1 in England. The other countries with RR results significantly greater than 1 included Germany, Austria, Canada, the United States, and the Netherlands. Similar to the patterns observed earlier, all of these countries are well developed economically and had high overall achievement on the PIRLS 2006 reading assessment.

In the United States, where students attending urban schools were 50 percent more likely than other students to score below the national 20th percentile in reading, the problems facing urban schools are well-recognized. The inequities found in this dissertation are consistent with national assessment results in the United States, where fourth grade students in central city schools had poorer reading skills than their peers in other school types (Donahue, Finnegan, Lutkus, Allen, & Campbell, 2001). Urban areas in the United States have higher rates of joblessness, poverty, and crime than other communities, and these issues disproportionately affect non-white ethnic groups, such as Hispanics and African-Americans (Wilson, 1998). School funding in the United States is largely drawn from local resources, and research has found that neighborhoods with higher socioeconomic status are likely to have greater school expenditures for each
student (Parrish, Matsumoto, & Fowler, 1995). Therefore, impoverished urban areas are likely to have fewer educational resources for their children.

**RRP Equity Index Results for Boys**

Table 4.8 presents the RRP Equity Index results for fourth grade boys in the PIRLS 2006 countries. In recent years, there has been an increasingly prominent gender gap in reading, with boys demonstrating fewer reading skills than girls. PIRLS 2001 and 2006 found that girls had significantly higher reading achievement than boys in nearly all countries (Mullis et al., 2007, Mullis et al., 2003). Though the gender difference was fairly small in some countries, it reached 67 points (more than half of a standard deviation) in Kuwait in PIRLS 2006. Other research has also examined gender differences in affect and motivation, finding that boys often enjoy reading less and have less motivation to do so (Guthrie & Greaney, 1991). For these reasons, boys were examined as a group at risk for low reading achievement.
Table 4.8 RRP Equity Index for Low Reading Achievement Internationally in PIRLS 2006 Countries for Fourth Grade Boys

<table>
<thead>
<tr>
<th>Country</th>
<th>RRP Equity Index</th>
<th>Percentage of Students Below Low Benchmark</th>
<th>Percentage of Students Who Are Boys</th>
<th>Percentage of Students Below Low Benchmark Who Are Boys</th>
<th>RR of Low Achievement Internationally for Boys</th>
<th>Percentage of Students Below the 25th Percentile Nationally Who Are Boys</th>
<th>RR of Low Achievement Nationally for Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td>Singapore</td>
<td>MRP 63</td>
<td>3 (0.4)</td>
<td>52 (0.6)</td>
<td>70 (2.9)</td>
<td>2.2 (0.3)</td>
<td>61 (1.6)</td>
<td>1.4 (0.1)</td>
</tr>
<tr>
<td>New Zealand</td>
<td>MRP 58</td>
<td>8 (0.6)</td>
<td>51 (1.0)</td>
<td>69 (2.3)</td>
<td>2.1 (0.2)</td>
<td>63 (1.5)</td>
<td>1.7 (0.1)</td>
</tr>
<tr>
<td>Slovenia</td>
<td>MRP 52</td>
<td>6 (0.5)</td>
<td>52 (0.7)</td>
<td>68 (2.8)</td>
<td>2.0 (0.2)</td>
<td>63 (1.7)</td>
<td>1.6 (0.1)</td>
</tr>
<tr>
<td>Canada</td>
<td>MRP 52</td>
<td>2 (0.2)</td>
<td>51 (0.6)</td>
<td>67 (3.6)</td>
<td>2.0 (0.3)</td>
<td>58 (1.2)</td>
<td>1.3 (0.1)</td>
</tr>
<tr>
<td>Austria</td>
<td>MRP 50</td>
<td>2 (0.4)</td>
<td>51 (0.7)</td>
<td>67 (4.9)</td>
<td>2.0 (0.4)</td>
<td>56 (1.8)</td>
<td>1.2 (0.1)</td>
</tr>
<tr>
<td>Iceland</td>
<td>MRP 50</td>
<td>7 (0.8)</td>
<td>50 (0.9)</td>
<td>67 (3.2)</td>
<td>2.0 (0.3)</td>
<td>62 (1.9)</td>
<td>1.6 (0.1)</td>
</tr>
<tr>
<td>Chinese Taipei</td>
<td>MRP 48</td>
<td>3 (0.4)</td>
<td>51 (0.5)</td>
<td>68 (3.7)</td>
<td>2.0 (0.3)</td>
<td>60 (1.5)</td>
<td>1.4 (0.1)</td>
</tr>
<tr>
<td>Scotland</td>
<td></td>
<td>45 (0.8)</td>
<td>49 (1.0)</td>
<td>65 (3.4)</td>
<td>1.9 (0.3)</td>
<td>58 (2.6)</td>
<td>1.4 (0.1)</td>
</tr>
<tr>
<td>Bulgaria</td>
<td></td>
<td>45 (1.0)</td>
<td>51 (1.0)</td>
<td>66 (5.2)</td>
<td>1.9 (0.4)</td>
<td>59 (2.7)</td>
<td>1.4 (0.1)</td>
</tr>
<tr>
<td>United States</td>
<td></td>
<td>40 (0.6)</td>
<td>49 (0.8)</td>
<td>64 (4.0)</td>
<td>1.8 (0.3)</td>
<td>56 (2.1)</td>
<td>1.3 (0.1)</td>
</tr>
<tr>
<td>Norway</td>
<td></td>
<td>38 (0.8)</td>
<td>51 (1.1)</td>
<td>64 (3.4)</td>
<td>1.8 (0.2)</td>
<td>61 (2.3)</td>
<td>1.5 (0.1)</td>
</tr>
<tr>
<td>France</td>
<td></td>
<td>34 (0.4)</td>
<td>51 (0.7)</td>
<td>64 (3.8)</td>
<td>1.7 (0.3)</td>
<td>58 (1.8)</td>
<td>1.3 (0.1)</td>
</tr>
<tr>
<td>Poland</td>
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<td>30 (0.7)</td>
<td>49 (0.8)</td>
<td>60 (3.4)</td>
<td>1.6 (0.2)</td>
<td>57 (1.9)</td>
<td>1.4 (0.1)</td>
</tr>
<tr>
<td>Moldova</td>
<td></td>
<td>26 (0.9)</td>
<td>50 (1.0)</td>
<td>60 (3.0)</td>
<td>1.5 (0.2)</td>
<td>58 (1.7)</td>
<td>1.4 (0.1)</td>
</tr>
<tr>
<td>Sweden</td>
<td></td>
<td>24 (0.5)</td>
<td>52 (1.1)</td>
<td>61 (3.5)</td>
<td>1.5 (0.3)</td>
<td>62 (2.1)</td>
<td>1.3 (0.1)</td>
</tr>
<tr>
<td>Denmark</td>
<td></td>
<td>22 (0.4)</td>
<td>49 (0.9)</td>
<td>58 (5.7)</td>
<td>1.5 (0.3)</td>
<td>54 (2.4)</td>
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<td>58 (1.9)</td>
<td>1.4 (0.1)</td>
</tr>
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</table>

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.7 of PIRLS 2006 International Report).

‡ Nearly satisfying guidelines for sample participation rates after replacement schools were included (see Exhibit A.7 of PIRLS 2006 International Report).

§ National Defined Population covers less than 95% of National Desired Population (see Exhibit A.4 of PIRLS 2006 International Report).

¶ National Defined Population covers less than 80% of National Desired Population (see Exhibit A.4 of PIRLS 2006 International Report).
Unlike other risk factors focused on in this dissertation, the percentage of students in the ‘at risk’ group varied little across the PIRLS 2006 since gender is generally evenly distributed. All countries had a fourth grade student population that was between 48 and 53 percent male. For this reason, the RRP values in Table 4.8, which are a composite of the relative risk ratio and the percentage of students in the ‘at risk’ group, rely primarily on the relative risk ratio. Higher RRP values for this risk factor generally indicate that boys were at greater risk of very low reading achievement relative to girls in that country. In 25 of the PIRLS 2006 countries, boys were more likely than girls to lack the reading skills associated with the Low International Benchmark.

Table 4.8 has several countries (seven) in the MRP category, indicating that boys were at least twice as likely as girls to score below the Low International Benchmark and they comprised at least 50 percent of fourth grade students in those countries. These countries included Singapore, New Zealand, Slovenia, Canada, Austria, Iceland, and Chinese Taipei. The RR values in these countries were fairly low with little variation, ranging from 2.0 to 2.2. Despite these relatively low levels of risk, the RRP values in these countries were substantial (ranging from 48 to 63) because of the high percentage of students in the ‘at risk’ group.

These MRP countries are a diverse group culturally, though they all had relatively few students (8% or less) below the Low International Benchmark. In some of these countries, the gender gap in reading is recognized and has been a topic of research and potential explanations have been explored. In New Zealand, for example, longitudinal
research has found that girls outperform boys throughout primary and secondary school in a variety of areas, including reading, despite similar IQ scores (Fergusson & Horwood, 1997). This underachievement was largely explained by disruptive classroom behaviors that were thought to impede male learning. Other work in New Zealand also suggests that gender differences vary across schools, and that well-educated teachers who were committed to meeting the diverse needs of their students had boys who were less behind girls in terms of achievement (Wilkinson, 1998).

Turning to the relative risk results that utilized the national 20th percentile as the threshold for low reading achievement, similar patterns emerged. Boys were at a significant risk of low reading achievement compared to girls in the nearly all (35) of PIRLS 2006 countries. However, the level of risk was below 2 in most countries. The exception was Kuwait, where boys were nearly three times as likely (RR = 2.8) to be in the bottom 20 percent of the national achievement distribution in reading compared to girls. This result is not surprising, given that Kuwait had the largest gender gap in achievement in PIRLS 2006.

The trend of inequity in reading outcomes for boys compared to girls is a challenge around the world. However, research has shown that there are ways to address the low reading achievement of boys. A school environment that supports a culture of reading is critical to encouraging boys’ reading (Clark & Foster, 2005). This may include consulting students on their reading preferences and providing a diverse range of reading materials to suit different levels and interests. It is also important to consider this
diversity of needs in the classroom (Younger & Warrington, 2005; Wilkinson, 1998). Teachers who provide interactive classroom activities and explicitly encourage boys to read are more likely to have boys who enjoy reading and have higher achievement. Such efforts, while increasing boys’ achievement and motivation, may also be beneficial to girls in the classroom.

**Relative Risk-Percentage Equity Index Results for Students with Multiple Risk Factors**

Examining the risk of low achievement associated with various student risk factors is a useful way to identify groups in inequitable situations. However, since these student characteristics are not mutually exclusive (with the exception of attending an urban or rural school), the extent to which students possess multiple risk factors was also examined. If many of the students examined in the previous exhibits as being at risk for low reading achievement are the same students, then this could help countries focus their efforts to provide assistance in literacy development. For example, if many of the students who attend rural schools also come from homes with little formal education, then these factors should be considered simultaneously when policy solutions are developed.

Additionally, if there appears to be an interaction between two risk factors, this can be important information for PIRLS countries. For example, if the relative risk ratio for students whose parents have less than secondary education attending rural schools was much higher than the results found for students with low parental education or students attending rural schools examined separately, this would suggest that the lack of
equity for students with both risk factors cannot be explained by parental education or school location alone. This provides further information to identify students who need assistance in reading the most.

However, as more characteristics are considered simultaneously, the number of students can become quite small in some countries, resulting in imprecise analyses and large standard errors. Therefore, characteristic combinations were limited to those that pertained to at least 15 percent of students internationally and those where one might logically expect an interaction to occur. Using these criteria, the following combinations of student risk factors were examined.

- Students attending rural schools whose parents have less than a secondary education
- Boys attending rural schools
- Boys attending urban schools

Students with these risk factor combinations were compared to all other students in the country.

**RRP Equity Index Results for Students Whose Parents Have Less than Secondary Education Attending Rural Schools**

Table 4.9 presents the RRP Equity Index results for students whose parents have less than secondary education attending rural schools, compared to all other students. This combination of risk factors for low reading achievement is important because it combines the low parental education risk factor that is a proxy for home resources with
the rural community risk factor that is associated with a lack of school resources in some countries.

There was a large degree of inequity in reading achievement for students with low parental education attending rural schools in a number of PIRLS 2006 countries. Six countries fell into the SR category, indicating that students in this ‘at risk’ group were at least three times as likely as their peers to score below the Low International Benchmark. These countries included Romania, Hungary, the Slovak Republic, Israel, Slovenia, and Norway. The high percentage of students (20%) in the ‘at risk’ group in Romania resulted in this country having the highest RRP value overall (44), despite the fact that the degree of inequity was much lower than in several other SR countries. Although fewer than 10 percent of students were impacted by this inequity in other SR countries, the level of risk for these few students was particularly high in Hungary and the Slovak Republic, with RR values reaching 6.7 and 9.9, respectively.

There were also four countries that were categorized with Moderate Risk, indicating that students with low parental education in rural schools were at least twice as likely as other students to lack basic reading skills. However, three of these countries (Bulgaria, Denmark, and New Zealand) had RR values that were not statistically different from one. The MR country with a statistically significant RR value was Poland, where 21 percent of students were in the ‘at risk’ group, and the RR value was 2.6. Because of this relatively high percentage of students at risk, Poland also had one of the highest RRP values (34) in Table 4.9.
Table 4.9 RRP Equity Index for Low Reading Achievement Internationally in PIRLS 2006 Countries for Fourth Grade Students Whose Parents Have Less than Secondary Education Attending Rural Schools

<table>
<thead>
<tr>
<th>Country</th>
<th>RRP Equity Index</th>
<th>Percentage of Students Below Low Benchmark</th>
<th>Percentage of Students Whose Parents Have Less than Secondary Education Attending Rural Schools</th>
<th>Percentage of Students Whose Parents Have Less than Secondary Education</th>
<th>Percentage of Students Below the 25th Percentile Nationally Attending Rural Schools Whose Parents Have Less than Secondary Education</th>
<th>RR of Low Achievement Internationally for Rural Students Whose Parents Have Less than Secondary Education</th>
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</thead>
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<tr>
<td>Romania</td>
<td>MR</td>
<td>46 (1.8)</td>
<td>20 (1.8)</td>
<td>44 (1.9)</td>
<td>3.2 (0.6)</td>
<td>41 (4.4)</td>
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<td>20 (1.8)</td>
<td>44 (1.9)</td>
<td>3.2 (0.6)</td>
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<td>6 (9.9)</td>
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<td>6.7 (2.2)</td>
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<td>3 (0.7)</td>
<td>10 (2.5)</td>
<td>3.1 (0.5)</td>
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<tr>
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<td>2 (0.4)</td>
<td>8 (2.2)</td>
<td>3.9 (1.0)</td>
<td>5 (1.2)</td>
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<td>9 (1.2)</td>
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</table>

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.7 of PIRLS 2006 International Report).
‡ Nearly satisfying guidelines for sample participation rates after replacement schools were included (see Exhibit A.7 of PIRLS 2006 International Report).
* National Defined Population covers less than 95% of National Desired Population (see Exhibit A.4 of PIRLS 2006 International Report).
§ National Defined Population covers less than 80% of National Desired Population (see Exhibit A.4 of PIRLS 2006 International Report).
(1) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
(2) Indicates data not available.
(3) Indicates insufficient data to report results.
- Severe GRR (Relative Risk Ratio >=3 for students in this country performing below Low Benchmark, as compared to other PIRLS countries)
- Moderate GRR (Relative Risk Ratio >=2 and < 3 for students in this country performing below Low Benchmark, as compared to other PIRLS countries)
In addition to the SR and MR countries, there were nine other countries where rural students whose parents have less than secondary education were significantly more likely than other students to score below the PIRLS 2006 Low International Benchmark. These countries included Indonesia, Moldova, Iran, Macedonia, Trinidad and Tobago, South Africa, Qatar, Morocco, and Kuwait. In Moldova, Iran, and Macedonia, the RR value was 1.9, just below the cutpoint of 2 for inclusion in the MR category.

In 21 of the PIRLS 2006 countries, these ‘at risk’ students were more likely than suburban or urban students and students with higher levels of parental education to score in the bottom 20 percent of their country’s reading achievement distribution. In the majority (18) of these countries, the RR value reached at least 2, indicating that students from families with little education in rural schools were at least twice as likely as other students to fall below the 20th percentile nationally. In some cases, the RR value was fairly high, reaching 3.3 in the Russian Federation and 4.2 in the Slovak Republic.

There were several countries in which a large number of students came from families with little formal education and attended rural schools. In Romania, Poland, Indonesia, Moldova, and Iran, more than 20 percent of fourth grade students possessed both of these characteristics associated with poor reading achievement. In most of these cases, the students in this composite ‘at risk’ group were a subset of each of the risk factors. In other words, not all rural students had low parental education, and not all students with low parental education attended rural schools. However, there were some exceptions where there was substantial overlap between these two risk factors.
In Romania, for example, 48 percent of students attended rural schools and 29 percent of students came from homes with low education levels. Twenty percent of students possessed both of these characteristics, indicating that most of the students with low parental education were also attending rural schools (20 out of 29%). This suggests that when the issue of low parental education is considered in the Romanian context, it is primarily an issue that impacts rural areas. Similarly, in Indonesia, 66 percent of the fourth grade student population had parents with little education and 74 percent of students lived in rural areas. As one would logically expect given that both of these risk factors apply to the majority of the population, there was substantial overlap between these two groups of students. Fifty-one percent of the students in Indonesia (the highest percentage in any PIRLS country) had low parental education and attended a rural school, suggesting that these two educational issues are intertwined to a large degree in this country.

Though there were some countries with substantial numbers of students in this composite ‘at risk’ group, in most of the PIRLS 2006 countries, few students attended rural schools and came from families with little formal education. In fact, there were a number of countries who had too few students (less than 2%) with both of these characteristics to report stable RRP Equity Index results, including Austria, Canada, England, Scotland, and Sweden.

There was also one country, Germany, where fourth grade rural students with low parental education were less likely than their peers (RR = 0.3) to demonstrate poor
reading skills on the PIRLS assessment. This result is particularly interesting, given that Germany had an extremely high RRP value (270) and level of relative risk (RR = 8.6) for students whose parents have less than secondary education when they were examined separately (shown in Table 4.3). In contrast, rural students in Germany were highly unlikely to score below the PIRLS 2006 Low International Benchmark, with an RR value of 0.2 (shown in Table 4.6). The similarly low level of risk for students with both characteristics suggests that rural students whose parents have little education were unlikely to have low reading achievement, despite the fact that having little parental education was strongly associated with low reading achievement in Germany overall.

**RRP Equity Index Results for Boys Attending Urban Schools and Boys Attending Rural Schools**

It seems reasonable to expect that boys would be equally likely to attend an urban school as they would a rural school, or a suburban school. Therefore, unlike the previous risk factor combination that was examined, there is no reason to think that there would be a disproportionate overlaps between boys and school location. Instead, this combination of risk factors was examined because an interaction may still exist between these two characteristics and the risk for low reading achievement.

For example, while boys and girls in urban settings may lack the same resources and face many of the same challenges in school, research suggests that they may react to these issues in different ways. A qualitative study of urban students in the United States found that males and females often had very different experiences in and reactions to school (Lopez, 2003). Lopez found that females often maintained optimistic attitudes
towards education, while males were more likely to develop negative attitudes. Research internationally has also shown that urban boys are more likely than other children to be involved in gangs and youth violence—activities that are often adverse to success in school (Krug, Dahlberg, Mercy, Zwi, & Lozano, 2002). For these reasons, urban boys may be at particular risk for low achievement in reading, and were examined as an ‘at risk’ group for this dissertation. The risk of low reading achievement for rural boys was also considered to provide additional information about the potential interaction between gender and geographical location. Table 4.10 presents the RRP Equity Index results for boys attending urban schools, while Table 4.11 presents the RRP Equity Index results for boys attending rural schools.

The RRP Equity Index results for urban boys follow the general trend found for urban students in general, with inequity in low reading achievement appearing in only a small group of countries. Despite plausible reasons to expect that urban boys might be at particularly high risk for poor reading achievement, the results of these analyses did not show any unusual interactions between gender and attending an urban school.
Table 4.10 RRP Equity Index for Low Reading Achievement Internationally in PIRLS 2006 Countries for Fourth Grade Boys Attending Urban Schools

<table>
<thead>
<tr>
<th>Country</th>
<th>RRP Equity Index</th>
<th>Percentage of Students Below Low Benchmark</th>
<th>Percentage of Students Who Are Boys Attending Urban Schools</th>
<th>RR of Low Achievement Internationally for Boys</th>
<th>Percentage of Students Below the 25th Percentile Nationally Who Are Boys Attending Urban Schools</th>
<th>RR of Low Achievement Nationally for Boys Attending Urban Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>MR 21</td>
<td>20 (0.4)</td>
<td>16 (1.6)</td>
<td>30 (5.3)</td>
<td>2.2 (0.5)</td>
<td>1.5 (1.1)</td>
</tr>
<tr>
<td>Germany</td>
<td>MR 20</td>
<td>3 (0.3)</td>
<td>17 (1.4)</td>
<td>30 (6.2)</td>
<td>2.2 (0.4)</td>
<td>21 (2.2)</td>
</tr>
<tr>
<td>Scotland</td>
<td>MR 13</td>
<td>7 (0.8)</td>
<td>12 (1.5)</td>
<td>22 (3.9)</td>
<td>2.1 (0.4)</td>
<td>17 (2.6)</td>
</tr>
<tr>
<td>Canada</td>
<td>2a</td>
<td>20 (0.2)</td>
<td>22 (1.5)</td>
<td>35 (4.6)</td>
<td>1.9 (0.3)</td>
<td>27 (2.2)</td>
</tr>
<tr>
<td>England</td>
<td>2b</td>
<td>15 (1.0)</td>
<td>19 (2.2)</td>
<td>30 (4.1)</td>
<td>1.8 (0.3)</td>
<td>27 (3.5)</td>
</tr>
<tr>
<td>Belgium (French)</td>
<td>2b</td>
<td>12 (0.7)</td>
<td>20 (1.9)</td>
<td>28 (4.7)</td>
<td>1.6 (0.3)</td>
<td>24 (3.3)</td>
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<tr>
<td>United States</td>
<td>2a</td>
<td>9 (0.6)</td>
<td>13 (1.7)</td>
<td>20 (3.9)</td>
<td>1.7 (0.4)</td>
<td>20 (2.4)</td>
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<tr>
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<td>6 (0.4)</td>
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<td>1.3 (0.3)</td>
<td>19 (2.9)</td>
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<td>Slovenia</td>
<td>2b</td>
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<td>18 (2.1)</td>
<td>22 (3.9)</td>
<td>1.3 (0.2)</td>
<td>19 (2.7)</td>
</tr>
<tr>
<td>New Zealand</td>
<td>2b</td>
<td>5 (0.6)</td>
<td>20 (1.7)</td>
<td>24 (3.5)</td>
<td>1.3 (0.2)</td>
<td>22 (2.6)</td>
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<tr>
<td>Sweden</td>
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<td>13 (2.0)</td>
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<td>15 (2.9)</td>
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<td>Denmark</td>
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<td>17 (2.5)</td>
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<td>2a</td>
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<td>30 (0.4)</td>
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<td>32 (1.2)</td>
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<td>2 (0.4)</td>
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<td>1.1 (0.0)</td>
<td>11 (3.3)</td>
</tr>
<tr>
<td>South Africa</td>
<td>2a</td>
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<td>9 (0.9)</td>
<td>7 (0.9)</td>
<td>0.9 (0.1)</td>
<td>6 (1.0)</td>
</tr>
<tr>
<td>Morocco</td>
<td>2a</td>
<td>7 (2.0)</td>
<td>14 (1.6)</td>
<td>13 (1.6)</td>
<td>0.9 (0.0)</td>
<td>8 (2.1)</td>
</tr>
<tr>
<td>Poland</td>
<td>2a</td>
<td>7 (0.7)</td>
<td>26 (1.1)</td>
<td>23 (2.9)</td>
<td>0.9 (0.1)</td>
<td>25 (1.9)</td>
</tr>
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<tr>
<td>Trinidad and Tobago</td>
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<td>36 (2.1)</td>
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<td>0.7 (0.1)</td>
<td>7 (2.3)</td>
</tr>
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<td>13 (1.1)</td>
<td>10 (5.0)</td>
<td>0.8 (0.4)</td>
<td>11 (2.2)</td>
</tr>
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<td>Moldova</td>
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<td>9 (0.9)</td>
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<td>0.7 (0.2)</td>
<td>11 (1.8)</td>
</tr>
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<td>Georgia</td>
<td>2a</td>
<td>18 (1.3)</td>
<td>20 (1.7)</td>
<td>17 (2.5)</td>
<td>0.8 (0.1)</td>
<td>17 (2.0)</td>
</tr>
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<td>5 (1.0)</td>
<td>34 (1.6)</td>
<td>30 (6.4)</td>
<td>0.8 (0.2)</td>
<td>32 (3.4)</td>
</tr>
<tr>
<td>Iran, Islamic Rep. of</td>
<td>2a</td>
<td>40 (1.6)</td>
<td>27 (2.1)</td>
<td>21 (2.7)</td>
<td>0.7 (0.1)</td>
<td>17 (3.0)</td>
</tr>
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<td>Macedonia, Rep. of</td>
<td>2a</td>
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<td>22 (1.7)</td>
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<td>0.6 (0.1)</td>
<td>14 (1.9)</td>
</tr>
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<td>2a</td>
<td>16 (1.8)</td>
<td>24 (1.3)</td>
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<td>17 (3.1)</td>
</tr>
<tr>
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<td>23 (3.2)</td>
</tr>
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<td>Slovak Republic</td>
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<td>26 (1.6)</td>
<td>17 (3.5)</td>
<td>0.6 (0.1)</td>
<td>22 (2.4)</td>
</tr>
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<td>14 (2.2)</td>
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<td>Hong Kong SAR</td>
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<td>9 (1.6)</td>
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</tr>
<tr>
<td>Italy</td>
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<td>-</td>
<td>24 (3.6)</td>
</tr>
<tr>
<td>Latvia</td>
<td>2a</td>
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<td>20 (0.8)</td>
<td>-</td>
<td>-</td>
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<td>Netherlands</td>
<td>2a</td>
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<td>36 (1.4)</td>
<td>-</td>
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<td>37 (2.7)</td>
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<tr>
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<td>10 (1.6)</td>
<td>-</td>
<td>-</td>
<td>15 (2.8)</td>
</tr>
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<td>Chinese Taipei</td>
<td>2a</td>
<td>-</td>
<td>3 (0.4)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>2a</td>
<td>-</td>
<td>1 (0.3)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Singapore</td>
<td>2a</td>
<td>-</td>
<td>3 (0.4)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.7 of PIRLS 2006 International Report).
‡ Nearly satisfying guidelines for sample participation rates after replacement schools were included (see Exhibit A.7 of PIRLS 2006 International Report).
§ National Defined Population covers less than 5% of National Desired Population (see Exhibit A.4 of PIRLS 2006 International Report).
¶ National Defined Population covers less than 80% of National Desired Population (see Exhibit A.4 of PIRLS 2006 International Report).
‖ Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
* Indicates data not available
†† Indicates insufficient data to report results
§§ Severe RRR (Relative Risk Ratio =>3) and High Percentage of Students in ‘At Risk’ Group (=> .50)
¶¶ Moderate RRR (Relative Risk Ratio =>2 and < 3) and High Percentage of Students in ‘At Risk’ Group (=> .50)
‖‖ Low RRR (Relative Risk Ratio =>2 and < 3) and High Percentage of Students in ‘At Risk’ Group (=> .50)
### Indicates risk significantly greater than 1
#### Indicates risk significantly less than 1
178
Three countries in Table 4.10 were categorized as having a Moderate Risk, indicating that urban boys were at least twice as likely as other students in that country to perform below the Low International Benchmark. These countries—Austria, Germany, and Scotland—are similar in many ways. Each country had few students score below the Low International Benchmark (7% or less), between 10 and 20 percent of students in the ‘at risk’ group, and a relative risk for these students just higher than 2 (though Germany’s RR value was not statistically different from one). These two latter characteristics resulted in fairly low RRP values for each of these three countries. Contextually, these countries also have common features, being highly developed Western European countries with one language predominantly used in education.

Three other countries where urban boys had a significant risk of low reading achievement relative to other fourth grade students seem to fit within this pattern. Canada, England, and the French speaking region of Belgium are also similar in terms of economic development, achievement on PIRLS 2006, the percentage of ‘at risk’ students, their level of relative risk, and the resulting RRP value. There were two other countries that also had RR values significantly greater than 1 for urban boys—Qatar and Kuwait. Unlike the countries previously discussed, these countries had extremely low RRP values (2 and 1, respectively) and relative risk values that were barely above 1 (1.1 in both cases). They also had much higher percentages of students scoring below the Low International Benchmark compared to the rest of the countries with significant RR values for this set of risk factors.
As was found for urban schools in general, there were also a number of countries (8) where urban boys had a lower risk of poor reading achievement relative to other fourth graders. These countries included Morocco, Indonesia, Iran, Macedonia, Romania, Spain, the Slovak Republic, and Israel. In general, the level of risk for urban boys fell somewhere between the RR values for boys and urban students considered separately. In Israel, however, the pattern was different. Israeli boys were significantly more likely than girls (RR = 1.3) to have poor reading skills. Urban students in Israel were relatively unlikely (RR = 0.4) to score below the Low International Benchmark. When the risk factors were considered simultaneously, the RR value was also 0.4, suggesting that urban boys have an equally low likelihood of scoring below the Low International Benchmark as urban students generally, despite their gender.

Boys attending urban schools were more likely than other students to score below the 20th percentile nationally in 11 PIRLS 2006 countries. The degree of inequity in these countries was fairly small, with a maximum relative risk ratio of 1.6 (in Scotland, England, and the United States). Echoing the trends seen when the Low International Benchmark was used as the threshold for low reading achievement, there were a greater number of countries (12) where urban boys had a decreased risk of scoring below the national 20th percentile relative to their peers.

To provide a balance to the results presented in Table 4.10, Table 4.11 shows the RRP Equity Index results for boys attending rural schools. Unlike the results for urban boys, there were several countries where an interaction between gender and attending a
rural school increased students’ risk of low achievement. In these countries, rural boys had a higher risk of low reading achievement than either rural students or boys when they were considered separately.

The countries where there appeared to be an interaction included Bulgaria, Poland, and the United States, each of which were shaded in Table 4.11 to indicate that rural boys were at least twice as likely as other fourth graders to have reading scores below the Low International Benchmark. Bulgaria was the only country that was categorized as having a Severe Risk, meaning that rural boys in this country were more than three times as likely (RR = 3.4) as other students to have scored below the Low International Benchmark on the PIRLS 2006 assessment. Both rural students and boys in general in Bulgaria had lower levels of relative risk (RR values of 2.8 and 1.9, respectively) than rural boys. This could possibly indicate that rural boys are a group at risk for low reading achievement that should be considered separately from boys or rural students in Bulgaria.

Similarly, in Poland and the United States, where fourth grade rural boys were at Moderate Risk of poor reading achievement compared to their peers (RR = 2.1 for both countries), neither of these risk factors considered separately were ranked as a Moderate Risk in these countries. This suggests that there may be some interaction between gender and a rural school location for Poland and the United States. There were also two other countries that were categorized as Moderate Risk for this combination of risk factors—Israel and the Slovak Republic, with RR values of 2.7 and 2.3, respectively.
### Table 4.11 RRP Equity Index for Low Reading Achievement Internationally in PIRLS 2006 Countries for Fourth Grade Boys Attending Rural Schools

<table>
<thead>
<tr>
<th>Country</th>
<th>RRP Equity Index</th>
<th>Percentage of Students Below Low Benchmark</th>
<th>Percentage of Students Who Are Boys Attending Rural Schools</th>
<th>Percentage of Students Who Are Boys Attending Rural Schools</th>
<th>RR of Low Achievement Internationally for Boys</th>
<th>Percentage of Students Below the 25th Percentile Nationally Who Are Boys Attending Rural Schools</th>
<th>RR of Low Achievement Nationally for Boys Attending Rural Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>SI</td>
<td>29</td>
<td>5 (1.0)</td>
<td>12 (1.3)</td>
<td>12 (0.1)</td>
<td>3.4 (1.1)</td>
<td>21 (4.3)</td>
</tr>
<tr>
<td>IS</td>
<td>MR</td>
<td>27</td>
<td>15 (1.2)</td>
<td>16 (1.8)</td>
<td>34 (4.4)</td>
<td>2.7 (0.4)</td>
<td>32 (3.7)</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>MR</td>
<td>27</td>
<td>6 (0.9)</td>
<td>21 (1.9)</td>
<td>37 (5.8)</td>
<td>2.3 (0.5)</td>
<td>33 (3.6)</td>
</tr>
<tr>
<td>Poland</td>
<td>MR</td>
<td>24</td>
<td>7 (0.7)</td>
<td>21 (1.2)</td>
<td>36 (4.0)</td>
<td>2.1 (0.3)</td>
<td>29 (2.5)</td>
</tr>
<tr>
<td>United States</td>
<td>MR</td>
<td>13</td>
<td>4 (0.6)</td>
<td>12 (1.5)</td>
<td>23 (4.1)</td>
<td>2.1 (0.5)</td>
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</tr>
<tr>
<td>Romania</td>
<td></td>
<td>22</td>
<td>16 (1.8)</td>
<td>25 (1.4)</td>
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<td>Moldova</td>
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<td>21</td>
<td>9 (0.9)</td>
<td>32 (1.6)</td>
<td>44 (3.8)</td>
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<td>42 (2.6)</td>
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<tr>
<td>Georgia</td>
<td></td>
<td>18</td>
<td>18 (1.3)</td>
<td>22 (1.7)</td>
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<td>1.8 (0.2)</td>
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<tr>
<td>Indonesia</td>
<td></td>
<td>17</td>
<td>46 (2.1)</td>
<td>38 (1.7)</td>
<td>47 (1.9)</td>
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<td>52 (2.5)</td>
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<td>14</td>
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<td>33 (4.4)</td>
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<td>32 (3.1)</td>
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<tr>
<td>Iran, Islamic Rep. of</td>
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<td>13</td>
<td>40 (1.6)</td>
<td>18 (2.1)</td>
<td>27 (3.2)</td>
<td>1.7 (0.2)</td>
<td>33 (4.4)</td>
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<tr>
<td>Hungary</td>
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<td>11</td>
<td>3 (0.3)</td>
<td>14 (0.9)</td>
<td>25 (6.2)</td>
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<td>Denmark</td>
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<td>25 (6.2)</td>
<td>1.7 (0.5)</td>
<td>21 (3.1)</td>
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<td>Trinidad and Tobago</td>
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<td>16 (1.7)</td>
<td>24 (3.0)</td>
<td>1.7 (0.1)</td>
<td>28 (4.0)</td>
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<tr>
<td>Macedonia, Rep. of</td>
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<td>10</td>
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<td>13 (1.3)</td>
<td>21 (7.3)</td>
<td>1.7 (0.2)</td>
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<td>1.7 (0.5)</td>
<td>15 (2.9)</td>
</tr>
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<td>38 (1.2)</td>
<td>34 (3.1)</td>
<td>1.2 (0.0)</td>
<td>46 (2.0)</td>
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<td>1.5 (0.3)</td>
<td>19 (3.0)</td>
</tr>
<tr>
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<td>8 (0.8)</td>
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<td>13 (0.4)</td>
<td>17 (2.3)</td>
<td>1.4 (0.2)</td>
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<td>14 (3.4)</td>
<td>1.4 (0.4)</td>
<td>12 (2.1)</td>
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<td>52 (2.1)</td>
<td>1.1 (0.1)</td>
<td>24 (3.9)</td>
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<td>14 (2.5)</td>
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<td>19 (2.7)</td>
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<tr>
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<td>11 (2.7)</td>
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<td>4 (0.6)</td>
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<td>0.3 (0.1)</td>
<td>15 (2.0)</td>
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<tr>
<td>Belgium (Flemish)</td>
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<td>1 (0.2)</td>
<td>20 (2.3)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Hong Kong SAR</td>
<td></td>
<td>1 (0.2)</td>
<td>2 (0.9)</td>
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<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Italy</td>
<td></td>
<td>2 (0.4)</td>
<td>8 (1.6)</td>
<td>--</td>
<td>--</td>
<td>13 (3.2)</td>
<td></td>
</tr>
<tr>
<td>Latvia</td>
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<td>2 (0.4)</td>
<td>14 (1.1)</td>
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<td>--</td>
<td>25 (3.1)</td>
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<tr>
<td>Lithuania</td>
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<td>13 (1.2)</td>
<td>--</td>
<td>--</td>
<td>23 (2.5)</td>
<td></td>
</tr>
<tr>
<td>Netherlands</td>
<td></td>
<td>1 (0.3)</td>
<td>17 (1.6)</td>
<td>--</td>
<td>--</td>
<td>19 (2.1)</td>
<td></td>
</tr>
<tr>
<td>Qatar</td>
<td></td>
<td>67 (0.7)</td>
<td>1 (0.0)</td>
<td>--</td>
<td>--</td>
<td>2 (0.4)</td>
<td></td>
</tr>
<tr>
<td>Russian Federation</td>
<td></td>
<td>2 (0.5)</td>
<td>16 (1.3)</td>
<td>--</td>
<td>--</td>
<td>32 (2.6)</td>
<td></td>
</tr>
<tr>
<td>Chinese Taipei</td>
<td></td>
<td>3 (0.4)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Luxembourg</td>
<td></td>
<td>1 (0.3)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Singapore</td>
<td></td>
<td>3 (0.4)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
</tbody>
</table>

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.7 of PIRLS 2006 International Report).

‡ Nearly satisfying guidelines for sample participation rates after replacement schools were included (see Exhibit A.7 of PIRLS 2006 International Report).

§ National Defined Population covers less than 95% of National Desired Population (see Exhibit A.4 of PIRLS 2006 International Report).

¶ National Defined Population covers less than 80% of National Desired Population (see Exhibit A.4 of PIRLS 2006 International Report).

†† Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

* Indicates data not available

Indicates insufficient data to report results

§ Severe GRR (Relative Risk Ratio >=3) and High Percentage of Students in 'At Risk' Group (>= 50)

¶ Moderate GRR (Relative Risk Ratio == 2 and < 3) and High Percentage of Students in 'At Risk' Group (>= 50)

MR = Moderate Risk (Relative Risk Ratio ==2 and < 3) and High Percentage of Students in 'At Risk' Group (>= 50)

MRP = Moderate Risk (Relative Risk Ratio ==2 and < 3) and High Percentage of Students in 'At Risk' Group (>= 50)

Indicates risk significantly greater than 1

Indicates risk significantly less than 1

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In all five of the shaded countries in Table 4.11, rural boys comprised a fair percentage of the population, ranging from 12 percent in Bulgaria and the United States to 21 percent in the Slovak Republic and Poland. In the PIRLS 2006 countries overall, there was a range in the percentage of students who were rural boys in each country, as one would expect given the variation in the percentage of rural students in general. This reached a maximum of 38 percent of students in Indonesia, with as little as one percent of students in this ‘at risk’ group in Qatar.

In addition to those with Severe or Moderate Risk, rural boys in 11 other countries had a significant risk of performing below the PIRLS 2006 Low International Benchmark relative to other students. Within this group, there was diversity in terms of countries’ overall achievement as indicated by the percentage of students in the overall population that scored below the Low International Benchmark. However, all of the countries (except Qatar) with a Severe or Moderate Global Relative Risk (GRR), indicating that the country as a whole had a high risk of poor reading achievement relative to other PIRLS countries, had relative risk ratios significantly greater than one.

Rural boys had a significant relative risk of scoring within the bottom 20 percent of their country’s reading achievement distribution in 21 countries, though the degree of inequity was generally small. Several of the countries with the largest relative risk ratios for this national reading achievement threshold were those with the fewest students scoring below the Low International Benchmark. These included Hong Kong SAR,
Latvia, Qatar, and the Russian Federation, which had the highest RR value (2.5) across the PIRLS 2006 countries.

**Summary of Relative Risk-Percentage Equity Index Results Across Countries**

Table 4.12 summarizes the RRP Equity Index results for low reading achievement across countries for all of the student characteristics that were examined. The countries in this table are arranged in descending order according to the percentage of fourth grade students who scored below the PIRLS 2006 Low International Benchmark, the threshold of low reading achievement that was primarily used in this dissertation.

For the countries listed at the top of Table 4.12 (South Africa through Indonesia), roughly half or more of the fourth grade students were unable to reach the Low International Benchmark. In these countries, such a large percentage of students fell below the threshold used to define low reading achievement that individual student characteristics were not as strongly related to low achievement as was found in other countries. Instead, the country itself was more of a risk factor for poor achievement in PIRLS 2006, as indicated by the Severe Global Relative Risk (GRR) categorizations for all of these countries.

However, for the bulk of the PIRLS 2006 countries in the middle of the table (generally Iran through Sweden), substantial inequities in reading achievement emerged using the RRP Equity Index for at least one of the student characteristics examined in this dissertation, meaning that countries have at least one shaded cell. These are countries
where the majority of students were able to demonstrate the basic reading skills associated with the Low International Benchmark, while a subset of students (2-40%) did not meet this threshold. Therefore, the RRP Equity Index’s use of the Low International Benchmark as an achievement cutpoint was useful in identifying the relative risk of belonging to this low-achieving subgroup associated with particular student characteristics for these countries.
<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage of Students Below Low Benchmark</th>
<th>RRP Equity Index Results for Students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Country</td>
<td>With Parents who Don’t Speak the Language of the Test Before Starting School</td>
</tr>
<tr>
<td>South Africa</td>
<td>78 (1.6)</td>
<td>18</td>
</tr>
<tr>
<td>Morocco</td>
<td>74 (2.0)</td>
<td>34</td>
</tr>
<tr>
<td>Kuwait</td>
<td>72 (1.2)</td>
<td>2</td>
</tr>
<tr>
<td>Qatar</td>
<td>67 (0.7)</td>
<td>8</td>
</tr>
<tr>
<td>Indonesia</td>
<td>46 (2.1)</td>
<td>60</td>
</tr>
<tr>
<td>Iran, Islamic Rep. of</td>
<td>40 (1.6)</td>
<td>MRP 119</td>
</tr>
<tr>
<td>Trinidad and Tobago</td>
<td>36 (2.1)</td>
<td>23</td>
</tr>
<tr>
<td>Macedonia, Rep. of</td>
<td>34 (1.4)</td>
<td>MRP 45</td>
</tr>
<tr>
<td>Georgia</td>
<td>19 (1.3)</td>
<td>3</td>
</tr>
<tr>
<td>Romania</td>
<td>16 (1.8)</td>
<td>SR 97</td>
</tr>
<tr>
<td>Israel</td>
<td>15 (1.2)</td>
<td>SR 05</td>
</tr>
<tr>
<td>Moldova</td>
<td>9 (0.9)</td>
<td>MRP 52</td>
</tr>
<tr>
<td>Norway</td>
<td>18 (1.3)</td>
<td>MRP 10</td>
</tr>
<tr>
<td>New Zealand (French)</td>
<td>8 (0.6)</td>
<td>SR 34</td>
</tr>
<tr>
<td>Belgium (French)</td>
<td>8 (0.7)</td>
<td>SR 46</td>
</tr>
<tr>
<td>England</td>
<td>7 (1.0)</td>
<td>SR 62</td>
</tr>
<tr>
<td>Scotland</td>
<td>7 (0.8)</td>
<td>MRP 19</td>
</tr>
<tr>
<td>Poland</td>
<td>7 (0.7)</td>
<td>SR 107</td>
</tr>
<tr>
<td>Iceland</td>
<td>7 (0.8)</td>
<td>SR 23</td>
</tr>
<tr>
<td>Spain</td>
<td>6 (0.8)</td>
<td>SR 84</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>6 (0.9)</td>
<td>SR 67</td>
</tr>
<tr>
<td>Slovenia</td>
<td>6 (0.5)</td>
<td>SR 22</td>
</tr>
<tr>
<td>France</td>
<td>4 (0.4)</td>
<td>MRP 23</td>
</tr>
<tr>
<td>United States</td>
<td>4 (0.6)</td>
<td>MRP 7</td>
</tr>
<tr>
<td>Denmark</td>
<td>4 (0.4)</td>
<td>MRP 24</td>
</tr>
<tr>
<td>Singapore</td>
<td>3 (0.4)</td>
<td>SR 62</td>
</tr>
<tr>
<td>Chinese Taipei</td>
<td>3 (0.4)</td>
<td>SR 16</td>
</tr>
<tr>
<td>Germany</td>
<td>3 (0.3)</td>
<td>SR 270</td>
</tr>
<tr>
<td>Hungary</td>
<td>3 (0.5)</td>
<td>SR 121</td>
</tr>
<tr>
<td>Austria</td>
<td>2 (0.4)</td>
<td>SR 21</td>
</tr>
<tr>
<td>Canada</td>
<td>2 (0.2)</td>
<td>SR 12</td>
</tr>
<tr>
<td>Sweden</td>
<td>2 (0.5)</td>
<td>SR 29</td>
</tr>
<tr>
<td>Italy</td>
<td>2 (0.4)</td>
<td>-</td>
</tr>
<tr>
<td>Latvia</td>
<td>2 (0.4)</td>
<td>-</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>2 (0.5)</td>
<td>-</td>
</tr>
<tr>
<td>Lithuania</td>
<td>1 (0.3)</td>
<td>-</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>1 (0.3)</td>
<td>-</td>
</tr>
<tr>
<td>Hong Kong SAR</td>
<td>1 (0.2)</td>
<td>-</td>
</tr>
<tr>
<td>Belgium (Flemish)</td>
<td>1 (0.2)</td>
<td>-</td>
</tr>
<tr>
<td>Netherlands</td>
<td>1 (0.3)</td>
<td>-</td>
</tr>
</tbody>
</table>

Notes:
- Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.7 of PIRLS 2006 International Report).
- Nearly satisfying guidelines for sample participation rates after replacement schools were included (see Exhibit A.7 of PIRLS 2006 International Report).
- Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.
- Indicates data not available
- Indicates insufficient data to report results
- Severe GRR (Relative Risk Ratio >=3 for students in this country performing below Low Benchmark, as compared to other PIRLS countries)
- Moderate GRR (Relative Risk Ratio >=2 and < 3 for students in this country performing below Low Benchmark, as compared to other PIRLS countries)

Severe GRR  (Relative Risk Ratio  >=3 for students in this country performing below Low Benchmark, as compared to other PIRLS countries)
For the student characteristics that were examined, no countries fell into the SRP category, which would mean that at least half of fourth grade students were at least three times as likely as other students to have poor reading achievement. Additionally, there were relatively few instances of the MRP categorization, where half the students in the country were twice as likely as other students to have low achievement in reading. Most of the examples of MRP occurred when boys were examined as the ‘at risk’ group.

Some countries did have student groups classified as being at Moderate or Severe Risk more frequently than others, with Austria categorized as having a Moderate or Severe Risk for five of the six risk factors examined. These five student groups were at least twice as likely as other students in Austria to lack the basic reading skills associated with the Low International Benchmark. Some may view this as a minor issue, given that few students (2%) overall in Austria fell below this reading achievement threshold in PIRLS 2006. However, there were other countries with similar levels of overall achievement (Canada, Sweden) that did not have inequity in literacy outcomes to this extent. Within these five characteristics that were associated with poor reading achievement in Austria, the highest RRP value (101) was for students who did not always speak the language of the test at home.

Germany and the Slovak Republic also had substantial inequity in reading outcomes for a number of student groups. In both of these countries, four of the six ‘at risk’ groups analyzed were at a Moderate or Severe Risk relative to other students. The groups most at risk for low reading achievement in Germany and the Slovak Republic
included students with low parental education, students who did not speak the language
of the test before starting school and those who did not always speak it at home. In
Germany, urban students were also at substantial risk of performing below the Low
International Benchmark relative to their peers, whereas rural students were at a
disproportionate risk in the Slovak Republic. There were also a number of countries that
had Moderate or Severe Risk for three of the risk factors for low reading achievement
studied in this dissertation. These countries included Chinese Taipei, Bulgaria, Slovenia,
England, and New Zealand.

In some countries, little inequity in low reading achievement was for the risk
factors examined. However, it is important to keep in mind that this dissertation
examined a limited number of student characteristics, and that there are other
characteristics that would be important to consider in particular countries. In the United
States, for example, it would be important to examine equity in reading achievement for
different racial or socioeconomic groups. Also, the United States did not have data
available for parental education (because it did not administer the parent questionnaire).

For countries at the bottom of Table 4.12 (Italy through the Netherlands), nearly
all students (more than 98%) possessed basic reading skills. In these cases, there were too
few students below the Low International Benchmark to compute meaningful RRP
Equity Index results. Where there were too many or too few low achieving students to
provide optimal information about equity in reading outcomes, the national threshold of
low reading achievement (bottom 20%) was a particularly important complement to the RRP Equity Index.

To provide additional information about the equity situations in relatively high achieving countries, RRP Equity Index values and categories also were calculated using the relative risk associated with scoring below the national 20th percentile. Table 4.13 summarizes these RRP Equity Index results for countries where five percent or less of the student population scored below the PIRLS 2006 Low International Benchmark. In these countries, the PIRLS 2006 Intermediate International Benchmark is that which most closely corresponds to the national 20th percentile. Therefore, the percentage of students within each country that scored below this achievement threshold is also provided and was used to sort countries.
For the higher-achieving subgroup of countries, the results mirror patterns found using the Low International Benchmark in Table 4.12. Students whose parents had less than secondary education had a greater risk of scoring in the bottom 20 percent of their country’s reading achievement distribution compared to students with better-educated parents in a large number (15 of 19) of the countries included in this table. Three countries, including Austria, Hungary, and the Russian Federation, were categorized as Severe Risk for this student group, indicating that students with low parental education

Table 4.13 Summary of RRP Equity Index Results for Low Reading Achievement Nationally in High-Achieving PIRLS 2006 Countries for Fourth Grade Students

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage of Students Below Intermediate Benchmark</th>
<th>With Parents with Less than Secondary Education</th>
<th>Who Didn’t Speak the Language of the Test Before Starting School</th>
<th>Attending Rural Schools</th>
<th>Attending Urban Schools</th>
<th>Who are Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>24 (1.2)</td>
<td>MR 16</td>
<td>2</td>
<td>12</td>
<td>1</td>
<td>17</td>
</tr>
<tr>
<td>2a United States</td>
<td>18 (1.4)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>15</td>
</tr>
<tr>
<td>2b Bulgaria</td>
<td>18 (1.8)</td>
<td>MR 27</td>
<td>9</td>
<td>23</td>
<td>17</td>
<td>21</td>
</tr>
<tr>
<td>Chinese Taipei</td>
<td>16 (1.0)</td>
<td>MR 6</td>
<td>-</td>
<td>-</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td>16 (1.1)</td>
<td>MR 5</td>
<td>6</td>
<td>-</td>
<td>-</td>
<td>13</td>
</tr>
<tr>
<td>2a Denmark</td>
<td>15 (1.1)</td>
<td>MR 14</td>
<td>3</td>
<td>7</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>Latvia</td>
<td>14 (1.1)</td>
<td>MR 5</td>
<td>MR 3</td>
<td>6</td>
<td>19</td>
<td>33</td>
</tr>
<tr>
<td>Lithuania</td>
<td>14 (0.9)</td>
<td>3</td>
<td>1</td>
<td>21</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Singapore</td>
<td>14 (1.0)</td>
<td>MR 32</td>
<td>8</td>
<td>34</td>
<td>-</td>
<td>23</td>
</tr>
<tr>
<td>Hungary</td>
<td>14 (1.1)</td>
<td>SR 40</td>
<td>-</td>
<td>2</td>
<td>22</td>
<td>7</td>
</tr>
<tr>
<td>Germany</td>
<td>14 (0.8)</td>
<td>MR 68</td>
<td>MR 9</td>
<td>MR 37</td>
<td>28</td>
<td>3</td>
</tr>
<tr>
<td>Canada</td>
<td>14 (0.6)</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>17</td>
</tr>
<tr>
<td>Italy</td>
<td>13 (1.3)</td>
<td>MR 40</td>
<td>2</td>
<td>6</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>Sweden</td>
<td>13 (1.3)</td>
<td>MR 11</td>
<td>MR 6</td>
<td>-</td>
<td>15</td>
<td>24</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>11 (0.5)</td>
<td>MR 83</td>
<td>41</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>10 (1.1)</td>
<td>MR 30</td>
<td>6</td>
<td>MR 3</td>
<td>22</td>
<td>23</td>
</tr>
<tr>
<td>2a Belgium (French)</td>
<td>10 (0.9)</td>
<td>MR 21</td>
<td>6</td>
<td>MR 29</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>2b Netherlands</td>
<td>9 (0.8)</td>
<td>MR 19</td>
<td>3</td>
<td>MR 17</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td>Hong Kong SAR</td>
<td>8 (0.8)</td>
<td>19</td>
<td>2</td>
<td>4</td>
<td>17</td>
<td></td>
</tr>
</tbody>
</table>

- *Severe GRR* (Relative Risk Ratio >= 3) and **High Percentage of Students in ‘At Risk’ Group (>= 50)**
- *Moderate GRR* (Relative Risk Ratio >= 2 and < 3) and **High Percentage of Students in ‘At Risk’ Group (>= 50)**
- *Nearly satisfying guidelines for sample participation rates only after replacement schools were included (see Exhibit A.7 of PIRLS 2006 International Report).*
- *National Defined Population covers less than 95% of National Desired Population (see Exhibit A.4 of PIRLS 2006 International Report).*
- *National Defined Population covers less than 80% of National Desired Population (see Exhibit A.4 of PIRLS 2006 International Report).*
- *Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.*
- *Indicates data not available*
- *Indicates insufficient data to report results*
- *Severe GRR (Relative Risk Ratio >=3 for students in this country performing below Low Benchmark, as compared to other PIRLS countries)*
- *Moderate GRR (Relative Risk Ratio >=2 and < 3 for students in this country performing below Low Benchmark, as compared to other PIRLS countries)*

For the higher-achieving subgroup of countries, the results mirror patterns found using the Low International Benchmark in Table 4.12. Students whose parents had less than secondary education had a greater risk of scoring in the bottom 20 percent of their country’s reading achievement distribution compared to students with better-educated parents in a large number (15 of 19) of the countries included in this table. Three countries, including Austria, Hungary, and the Russian Federation, were categorized as Severe Risk for this student group, indicating that students with low parental education
were at least three times as likely as their peers to score at the lowest levels of national reading achievement at the fourth grade.

The RRP Equity Index results also varied by country, and again the patterns resembled the results shown in Table 4.12. Austria and Germany, both of which also had substantial levels of inequity associated with scoring below the Low International Benchmark, had at least a Moderate Risk for three of the five student groups that were examined for these analyses using the national 20th percentile. In addition, several countries (Chinese Taipei, Latvia, Sweden, the Russian Federation, and Flemish Belgium) were categorized with at least a Moderate level of inequity for two of the five ‘at risk’ student groups.

**Within-Country Logistic Regression Models Exploring the Relationship Between Resources and Student Risk Factors**

The RRP Equity Index is an effective way to communicate information across countries about student groups at particular risk for low reading achievement based on PIRLS 2006. Once ‘at risk’ student groups have been identified in particular countries, however, it may be necessary to conduct further analyses to dig deeper into reasons for these inequities. One way to do this would be to adopt an approach based on logistic regression. Logistic regression uses multiple variables to predict a dichotomous outcome—such as, whether or not students have reading achievement in the bottom 20 percent of the national achievement distribution.
To demonstrate how countries can conduct further analyses about ‘at risk’ student groups, three countries were selected—Germany, Iran, and Romania—to provide examples of how issues of equity might be addressed within a national context. These countries were selected based on the results of previous analyses and because they represent a range of cultures and achievement levels in PIRLS 2006. For each country, Table 4.14 shows the average PIRLS achievement score, the ‘at risk’ group examined, the percentage of students in the ‘at risk’ group, and their relative risk of being in the lower 20 percent of reading achievement compared to their peers in the country.

Table 4.14 Countries Selected for Logistic Regression Analyses

<table>
<thead>
<tr>
<th>Country</th>
<th>Average PIRLS 2006 Achievement</th>
<th>‘At Risk’ Group</th>
<th>Percentage of Students in ‘At Risk’ Group</th>
<th>Relative Risk of Scoring Below National 20th Percentile for ‘At Risk’ Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>548 (2.2)</td>
<td>Students attending urban schools</td>
<td>37%</td>
<td>1.8 (0.2)</td>
</tr>
<tr>
<td>Romania</td>
<td>489 (5.0)</td>
<td>Students whose parents have less than secondary education</td>
<td>29%</td>
<td>3.5 (0.4)</td>
</tr>
<tr>
<td>Iran</td>
<td>421 (3.1)</td>
<td>Students who did not speak that language of the test before starting school</td>
<td>25%</td>
<td>2.5 (0.3)</td>
</tr>
</tbody>
</table>

In each of these countries, logistic regression models were built that statistically controlled for differences in resources between students in the ‘at risk’ group and students who were not in this group. This was done to estimate the extent to which differences between the ‘at risk’ group and other students in the likelihood of scoring in the bottom 20 percent of the national achievement distribution could be attributed to differences in the resources that were available to them.
To select the resource variables to be included in the logistic regression model for each country, relative risk ratios were calculated for each of the 261 PIRLS background variables that were considered resources. Variables with a relative risk ratio greater than 2, meaning that students lacking (or with) that particular resource were twice as likely be in the bottom 20 percent of the country’s reading achievement distribution compared to other fourth grade students, were highlighted as resource risk factors.

Using these resource risk factors as predictors, the extent to which having or lacking resources could help explain the relationship between the student risk factor (e.g., attending an urban school) and lower reading achievement was explored. This was accomplished by building a Base Model with the student risk factor as the only predictor of having reading achievement below the national 20\(^{th}\) percentile, and then comparing this Base Model to an Extended Model that included both resource risk factors and the student risk factor. If accounting for resource variables reduced the risk for reading achievement below the national 20\(^{th}\) percentile associated with attending an urban school, for example, the relative risk ratio associated with urban schools would be less in the Extended Model than in the Base Model.

**Exploring the Risk of Reading Achievement Below National 20\(^{th}\) Percentile for Urban Students in Germany Using Logistic Regression**

As shown in Table 4.14, students in Germany attending urban schools comprised more than a third (37\%) of the fourth grade student population and were nearly twice as likely (RR = 1.8) as students in rural or suburban schools to have scored below the 20\(^{th}\)
percentile nationally. This was one of the highest relative risk ratios found for urban students across the PIRLS 2006 countries when the national 20\textsuperscript{th} percentile threshold of reading achievement was applied.

Table 4.15 presents the background variables that were included in the logistic regression models for Germany, with Response Category 1 (shown in the third column) being the risk factor for being in the bottom 20 percent of German fourth graders. Each of these risk factors had an RR value of at least 2, indicating that students with the risk factor were at least twice as likely as their classmates to have poorer achievement in reading. These variables can be described in two groups—home resources and school population variables.
Table 4.15 Variables Included in Logistic Regression Model of Reading Achievement Below the National 20th Percentile for Germany

<table>
<thead>
<tr>
<th>Variable Description</th>
<th>Data Provided By</th>
<th>Response Category 1</th>
<th>Response Category 2</th>
<th>Variable Category</th>
<th>Relative Risk for Students in Response Category 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>How would you describe the area where your school is located?</td>
<td>Principals</td>
<td>Urban</td>
<td>Suburban or Rural</td>
<td>Student Characteristic</td>
<td>1.8 (0.2)</td>
</tr>
<tr>
<td>Combined Books in the Home(^5)</td>
<td>Students and Parents</td>
<td>Low</td>
<td>Medium or High</td>
<td>Resource</td>
<td>2.9 (0.3)</td>
</tr>
<tr>
<td>What kind of work does the child’s father/stepfather/male guardian do for his main job?</td>
<td>Parents</td>
<td>Non-professional or doesn’t work (fishery, craft, machine operator, laborer, n/a)</td>
<td>Professional (sm. business owner, clerk, service wkr, corporate, professional, technician)</td>
<td>Resource</td>
<td>2.9 (0.2)</td>
</tr>
<tr>
<td>Do you have a computer at home?</td>
<td>Students</td>
<td>No</td>
<td>Yes</td>
<td>Resource</td>
<td>3.2 (0.2)</td>
</tr>
<tr>
<td>Approximately what percentage of students in your school come from economically disadvantaged homes?</td>
<td>Principals</td>
<td>More than 50%</td>
<td>50% or less</td>
<td>Resource</td>
<td>3.6 (0.3)</td>
</tr>
<tr>
<td>For the &lt;fourth-grade&gt; students in your school, about how many students receive free or reduced-price lunch?</td>
<td>Principals</td>
<td>All</td>
<td>Some or None</td>
<td>Resource</td>
<td>3.8 (0.6)</td>
</tr>
</tbody>
</table>

Home resource variables that were strongly associated with reading achievement in Germany included a computer (RR = 3.2) and many books (RR = 2.9), the absence of which could directly affect a students’ ability to develop reading skills. Students lacking either of these resources were approximately three times as likely as other German students to have reading achievement below the national 20th percentile. In conjunction with the finding that students whose fathers were in non-professional occupations had a high risk of low achievement (RR = 2.9), these results are consistent with studies that show the challenges that many immigrant families face when they enter a new country.

\(^5\) Several measures of books in the home emerged as resource risk factors for Germany, Iran, and Romania. These variables included parents’ reports of the number of children’s books and the number of books overall in their home, as well as students’ reports of whether or not they have books of their own at home. Because these variables all measured the same basic construct—the presence of reading materials in the home—they were combined into a single index variable to be used in the logistic regression models.
such as having lower socioeconomic status and less access to resources (Gradstein & Schiff, 2004).

Previous work has shown that urban schools in Germany have a large number of immigrant students, with students from immigrant families comprising 80 percent of some inner-city classes (Hornberg, Bos, Lankes, Valtin, 2007). In general, immigrant students in Germany tend to have poorer academic achievement than their native peers (Schwippert, 2007). While meeting the needs of immigrant students is a challenge that many countries face, previous research suggests that immigrant students in Germany have lower performance in reading than comparative immigrant groups in other countries (Mannitz, 2004).

Fourth grade students in Germany attending schools with large proportions of disadvantaged students (as measured by principals’ judgments and the proportion of students receiving free lunch) also had a particularly high risk of having lower reading achievement than German students in schools with a more advantaged student body. Relative risk ratios larger than 3 were associated with both school population variables—principals’ reports that more than half of the schools’ students were disadvantaged and principals’ reports that all students received free or reduced-price lunch (3.6 and 3.8, respectively). This is also consistent with research cited previously suggesting that many urban classrooms in Germany tend to have high concentrations of immigrant students.

When considered together, the resource variables related to having reading achievement below the national 20th percentile suggest that lower achieving students in
Germany are lacking resources in the home, and are likely to attend schools with students from similar backgrounds. Logistic regression models were used to examine the extent to which these home and school resource variables could be used to explain the lower reading achievement of urban students relative to other German students.

**Logistic Regression Model Results for Germany**

Table 4.16 presents the results of the logistic regression models for Germany. The Base Model contained the student risk factor of attending an urban school as the only predictor of having reading achievement below the national 20th percentile. The Extended Model built on this Base Model by including factors that might ameliorate the urban school effect as a predictor of reading achievement. The first section of this table presents the overall significance of the Base Model and the Extended Model, using an adjusted Wald F test (F = 25.7 and 77.4, respectively). As one would expect due to the RRP Equity Index results for attending an urban school and the large sample sizes available in the PIRLS 2006 database, both of the overall models were highly significant (p < .005).
Table 4.16 Results of Logistic Regression Models of Reading Achievement Below the National 20\textsuperscript{th} Percentile for Germany

<table>
<thead>
<tr>
<th>OVERALL MODEL SIGNIFICANCE</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>F</td>
<td>p</td>
</tr>
<tr>
<td>Base Model</td>
<td>25.7</td>
<td>&lt; .005</td>
</tr>
<tr>
<td>Extended Model</td>
<td>77.4</td>
<td>&lt; .005</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VARIABLE COEFFICIENTS</th>
<th>Base Model Coefficient</th>
<th>p</th>
<th>Extended Model Coefficient</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attending an urban school</td>
<td>0.7</td>
<td>&lt; .005</td>
<td>0.3</td>
<td>0.19</td>
</tr>
<tr>
<td>Few books at home</td>
<td>--</td>
<td>--</td>
<td>1.2</td>
<td>&lt; .005</td>
</tr>
<tr>
<td>Father's occupation</td>
<td>--</td>
<td>--</td>
<td>0.8</td>
<td>&lt; .005</td>
</tr>
<tr>
<td>No computer at home</td>
<td>--</td>
<td>--</td>
<td>1.3</td>
<td>&lt; .005</td>
</tr>
<tr>
<td>Attending a school</td>
<td>--</td>
<td>--</td>
<td>1.1</td>
<td>&lt; .005</td>
</tr>
<tr>
<td>Attending a school where</td>
<td>--</td>
<td>--</td>
<td>1.0</td>
<td>0.04</td>
</tr>
<tr>
<td>more than 50% of students</td>
<td>--</td>
<td>--</td>
<td>1.0</td>
<td>0.04</td>
</tr>
<tr>
<td>come from economically</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>disadvantaged homes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attending a school where</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>all &lt;fourth-grade&gt; students</td>
<td>1.0</td>
<td>0.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>receive free or reduced-price lunch</td>
<td>1.0</td>
<td>0.04</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RELATIVE RISK AND ODDS RATIO ASSOCIATED WITH ATTENDING AN URBAN SCHOOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>----------------------------</td>
</tr>
<tr>
<td>Base Model</td>
</tr>
<tr>
<td>Extended Model</td>
</tr>
</tbody>
</table>

The second section of Table 4.16 presents the logistic regression coefficients associated with each of the predictors and their statistical significance for the Base Model and the Extended Model. These coefficients indicate the amount of change expected in the log odds of the outcome, reading achievement below the 20\textsuperscript{th} percentile, when there is a one unit change in the predictor variable. In these models, where all of the variables have only two values, the amount of change is associated with a student having a particular risk factor (versus not having the risk factor). For example, for the student risk factor in the Base Model, attending an urban school, the coefficient of 0.7 indicates that the model predicts an increase in the likelihood of reading achievement below the
national 20th percentile of 0.7 logits if a student were to move from a suburban or rural school to an urban school, which was highly significant (p < .005).

Because the interpretation of these logistic regression coefficients is not very intuitive, the third section of Table 4.16 presents the relative risk ratio and odds ratio associated with attending an urban school in Germany. These statistics are both transformations of the logistic regression coefficients presented in the second section of the table. Still focusing on the Base Model, the relative risk ratio associated with attending an urban school was 1.8—identical to the results of the cross-country analyses, as one would expect. This RR value for urban students in Germany, indicating that they were nearly twice as likely as their peers to achieve in the bottom 20 percent of German reading achievement, was the impetus for building these logistic regression models in the first place.

The odds ratio and its confidence interval are also presented to provide a measure of statistical significance, because the formula used to produce relative risk ratios in logistic regression has been shown to produce biased confidence intervals (Robbins, Chao, & Fonseca, 2002). The odds ratio presents the odds of having reading achievement below the national 20th percentile for urban students. While the results are often similar to the relative risk ratio, the odds ratio tends to be inflated when the number of students with the outcome of interest—in this case, reading achievement below the national 20th percentile, is relatively small. The odds ratio of the Base Model indicates that the odds of reading achievement below this threshold for students in urban schools were essentially
twice as large (OR = 2.1) as the odds for students in other types of schools in Germany. Because the lower bound of this statistic’s confidence interval of 1.5 was greater than one, these odds in the Base Model and thus, the relative risk ratio, were statistically significant.

In short, this Base Model confirms that urban students were more likely to be in the bottom 20 percent of the German reading achievement distribution than their peers—restating information that had already been gained from previous analyses in the form of a logistic regression model. The Extended Model built on the Base Model by including resource risk factors as predictors of reading achievement below the 20th percentile in addition to attending an urban school.

Including the resource risk factors in the Extended Model reduced the likelihood of students attending urban schools scoring in the lower 20 percent of the German achievement distribution, with a regression coefficient of 0.3 compared to 0.7 for the Base Model. The 0.3 coefficient was not statistically significant. The odds ratio associated with attending an urban school dropped from 2.1 in the Base Model to 1.3 in the Extended Model—a result that was statistically significant in the Base Model but no longer significant once differences in resources were accounted for. The relative risk ratio associated with attending an urban school similarly decreased from 1.8 to 1.3. Overall, the Extended Model suggests that if urban students had access to the same home resources as non-urban students and were not in schools with large numbers of other
disadvantaged children, they would be much less likely to have a disproportionately high risk of achievement below the national 20\textsuperscript{th} percentile in reading.

The regression coefficients of the resource risk factors included in the Extended Model (shown in the second section of Table 4.16) suggest that lacking home resources and attending schools with large numbers of disadvantaged students were more strongly related to being at the bottom of the German reading achievement distribution than was attending an urban school. In particular, having few books in the home and not owning a computer were important predictors, with coefficients of 1.2 and 1.3, respectively. The reduction that these resources had on the urban school effect suggests that this effect may be largely a proxy for more fundamental resource shortages in the home.

**Exploring the Risk of Reading Achievement Below National 20\textsuperscript{th} Percentile for Students Who Did Not Speak the Language of the Test Before Starting School in Iran Using Logistic Regression**

Iranian students were tested in Farsi (Persian), the national language and the language of instruction in all schools. Yet 25 percent of the fourth grade students in Iran did not speak Farsi before starting school, most likely because they belong to one of the ethnic groups that speak a different language, such as Turkish, Kurdish, Lori, and Arabic (Karimi & Bakhshalizadeh, 2007).

As shown previously in Table 4.14, this ‘at risk’ group had an RR value of 2.5 when the national threshold of low reading achievement was applied, indicating that students who did not speak Farsi before starting school were 2.5 times as likely as Farsi speakers to score in the bottom 20 percent of the Iranian reading achievement distribution.
on the PIRLS 2006 assessment. Some research has suggested that many of the students who do not speak Farsi before starting school may be part of the Turkish-speaking community, which comprises 26 percent of Iran’s population (Hameedy, 2004; Karimi & Bakhshalizadeh, 2007). This Turkish-speaking community largely resides in provinces located in the northwestern region of Iran. According to Hameedy (2004), in the largest of these provinces, only 41 percent of inhabitants speak Farsi.

The purpose of this analysis was to determine the extent to which the disproportionately high risk of reading achievement below the national 20th percentile for second language students relative to their classmates could be explained by differences in resources between students who did not speak Farsi before school and students who did. Table 4.17 presents the home and school resource variables most closely related to poor reading achievement on PIRLS in Iran. Focusing on the home arena, students who had few books in the home were nearly four times as likely (RR = 3.6) as students with more books to have scored in the bottom 20 percent of the Iranian reading achievement distribution. Additionally, fourth grade students that lacked a computer at home were nearly three times as likely (RR = 2.8) as other students to have lower reading achievement on PIRLS 2006.
Table 4.17 Variables Included in Logistic Regression Model of Reading Achievement Below the National 20th Percentile for Iran

<table>
<thead>
<tr>
<th>Variable Description</th>
<th>Data Provided By</th>
<th>Response Category 1</th>
<th>Response Category 2</th>
<th>Variable Category</th>
<th>Relative Risk for Students in Response Category 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did you speak &lt;language of test&gt; before you started school?</td>
<td>Students</td>
<td>No</td>
<td>Yes</td>
<td>Student Characteristic</td>
<td>2.5 (0.3)</td>
</tr>
<tr>
<td>Combined Books in the Home</td>
<td>Students and Parents</td>
<td>Low</td>
<td>Medium or High</td>
<td>Resource</td>
<td>3.6 (0.7)</td>
</tr>
<tr>
<td>In what language did most of the activities in question 2 take place? (early home literacy activities)</td>
<td>Parents</td>
<td>Other Language</td>
<td>Language of Test</td>
<td>Resource</td>
<td>2.6 (0.3)</td>
</tr>
<tr>
<td>Do you have a computer at home?</td>
<td>Students</td>
<td>No</td>
<td>Yes</td>
<td>Resource</td>
<td>2.8 (0.4)</td>
</tr>
<tr>
<td>How old are you?</td>
<td>Teachers</td>
<td>Under 30</td>
<td>30 or older</td>
<td>Resource</td>
<td>2.7 (0.4)</td>
</tr>
<tr>
<td>Are parent education programs (e.g., classes on child development, education on being a parent) available at your school site for the children and families in your school?</td>
<td>Principals</td>
<td>No</td>
<td>Yes</td>
<td>Resource</td>
<td>2.7 (0.3)</td>
</tr>
</tbody>
</table>

Early exposure to Farsi was also strongly related to reading achievement. Students who did early literacy activities with their parents, such as reading or telling stories, in a language other than Farsi were more than twice as likely (RR = 2.6) to have low reading achievement at the fourth grade than students who did these things in the language of the test.

In the classroom, students with teachers under the age of 30 had an RR value of 2.7, indicating that they were 2.7 times as likely as students with older teachers to have PIRLS 2006 reading scores below the national 20th percentile. Additionally, students in schools that lacked parent education programs had an elevated risk of low reading achievement (RR = 2.7) compared to other fourth graders in Iran.
Unlike some risk factors (such as the previous example of attending an urban school), a lack of exposure to the language of instruction is not simply a characteristic associated with low reading achievement, but is also a plausible cause of poor reading skills in the language of instruction. Therefore, the distribution of resources (using the original response categories) for students who spoke Farsi before starting school and those who did not speak Farsi were compared (excluding the language used in preschool literacy activities). This was done to determine the extent to which access to these resources differed between the two student groups, to provide support for a logistic regression modeling approach that focuses on resources. The percentage of students within each response category compared across the two language groups are presented below in Table 4.18.
Table 4.18 shows that a high percentage (70%) of those students who did not speak Farsi also had very few (0-10) books to read at home compared to students who did speak Farsi (47%). Also, similar to books in the home, a substantially higher percentage (28% compared to 12%) of students who did not speak Farsi before starting school lacked access to a computer in their home. While the teachers for both student groups tended to be between the ages of 30 and 49, there was a higher percentage of students who did not speak Farsi before starting school who had fourth grade teachers under the age of 30 (16 percent compared to 5 percent). Finally, 45 percent of students who did not speak Farsi...
compared to 81 percent who did speak Farsi attended schools with parental education programs.

Across the resources that were strongly related to low reading achievement at the fourth grade in Iran, there appear to be substantial differences according to the language students spoke before entering school. This suggests that the higher risk of low reading achievement for students who did not speak Farsi before school may be related to the resources that these students had access to, and not simply a result of a lack of exposure to the language of instruction at an early age. Based on these preliminary analyses, all of these resources were included in the logistic regression model for Iran, in order to statistically examine the impact of resources on the likelihood of scoring below the national 20th percentile in reading achievement.

**Logistic Regression Model Results for Iran**

Using these variables, Table 4.19 presents the results for the Base and Extended logistic regression models for Iran. Both of the overall models were highly significant (p < .005), indicated by the adjusted Wald F statistic (49.6 and 33.3, respectively).
Table 4.19 Results of Logistic Regression Models of Reading Achievement Below the National 20th Percentile for Iran

<table>
<thead>
<tr>
<th>OVERALL MODEL SIGNIFICANCE</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>F</td>
<td>p</td>
</tr>
<tr>
<td>Base Model</td>
<td>49.6</td>
<td>&lt; .005</td>
</tr>
<tr>
<td>Extended Model</td>
<td>33.3</td>
<td>&lt; .005</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VARIABLE COEFFICIENTS</th>
<th>Base Model Coefficient</th>
<th>p</th>
<th>Extended Model Coefficient</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did not speak &lt;language of test&gt; before starting school</td>
<td>1.2</td>
<td>&lt; .005</td>
<td>0.4</td>
<td>0.05</td>
</tr>
<tr>
<td>Few books at home</td>
<td>--</td>
<td>--</td>
<td>1.0</td>
<td>&lt; .005</td>
</tr>
<tr>
<td>Did early literacy activities in language other than &lt;language of test&gt;</td>
<td>--</td>
<td>--</td>
<td>0.6</td>
<td>&lt; .02</td>
</tr>
<tr>
<td>No computer at home</td>
<td>--</td>
<td>--</td>
<td>0.6</td>
<td>&lt; .005</td>
</tr>
<tr>
<td>Has teacher under the age of 30</td>
<td>--</td>
<td>--</td>
<td>0.8</td>
<td>&lt; .005</td>
</tr>
<tr>
<td>Parent education programs (e.g., classes on child development, education on being a parent) are not available at school site for children and families</td>
<td>--</td>
<td>--</td>
<td>0.8</td>
<td>0.02</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RELATIVE RISK AND ODDS RATIO FOR STUDENT RISK FACTOR</th>
<th>Relative Risk Ratio</th>
<th>Odds Ratio</th>
<th>Lower Bound</th>
<th>Upper Bound</th>
<th>Odds Ratio Significantly Different From Base Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Model</td>
<td>2.5</td>
<td>3.3</td>
<td>2.3</td>
<td>4.6</td>
<td>--</td>
</tr>
<tr>
<td>Extended Model</td>
<td>1.4</td>
<td>1.5</td>
<td>1.0</td>
<td>2.2</td>
<td>YES</td>
</tr>
</tbody>
</table>

The single predictor included in the Base Model, not speaking the language of the test before starting school, was highly significant (p < .005) with a coefficient of 1.2. This coefficient can be interpreted using the odds ratio and relative risk ratio for the Base Model presented in the third section of Table 4.19. In this case, the odds ratio of 3.3 indicates that students who did not speak Farsi before starting primary school had greater than 3 to 1 odds of having reading achievement below the national 20th percentile compared to students with early exposure to Farsi. Because the lower bound of this statistic (2.3) was well above one, this estimate is unlikely to be due to chance. When the odds ratio was transformed into a relative risk ratio (2.5), the result was, as expected, identical to earlier relative risk analyses indicating that this ‘at risk’ group was 2.5 times
as likely as their classmates to be in the bottom 20 percent of Iran’s reading achievement
distribution for PIRLS 2006.

Table 4.19 also includes the results for the Extended Model in Iran, which
included the student risk factor of not speaking the language of the test before starting
school as well as resource risk factors as predictors of reading achievement below the
national 20th percentile. The purpose of this Extended Model was to examine the extent to
which the likelihood of lower reading achievement for students who did not speak the
language of the test before school could be explained by a lack of resources available to
these students relative to the resources available to their peers. This is accomplished by
comparing the results of Extended Model to the results of Base Model that were
discussed above.

After accounting for resource risk factors in the Extended Model, the risk of low
reading achievement for second language students dropped dramatically. The regression
coefficient associated with not speaking Farsi before starting school decreased from 1.2
to 0.4, which was not statistically different from zero (p = .05). The impact of resources is
also shown by the reduction in the odds ratio and relative risk ratio between the Base and
Extended Models. In the Extended Model, second language students had an RR value of
1.4, as compared to a RR value of 2.5 for the Base Model. Similarly, the odds ratio
decreased by more than half, from a value of 3.3 in the Base Model to 1.5 in the
Extended Model, which was not statistically different from 1. This indicates that, once
resources were accounted for, second language students were not any more likely than
native speakers to be among the poorest readers in Iran. If students who did not speak Farsi before starting school were given the same resources at home and at school as their peers, these models estimate that they could very well be as successful as their peers in reading at the fourth grade.

The coefficients for all of the resource risk factors in the Extended Model were statistically significant and suggest that resources were more strongly related to scoring below the national 20th percentile than a student’s language background. As might be expected given the fundamental relationship between books and reading, books in the home stood out as a particularly important resource, with the largest coefficient (1.0) of all of the predictors in the Extended Model. In summary, these logistic regression results suggest that second language students in Iran were likely to lack resources to support reading at home and to attend schools with less-experienced teachers and less support for families (as measured by parental education programs), and that this seems to have contributed to their lower reading achievement on PIRLS 2006.

**Exploring the Risk of Reading Achievement Below National 20th Percentile for Students Whose Parents Have Less than Secondary Education in Romania Using Logistic Regression**

Students whose parents had less than a secondary education in Romania were the students of interest in these analyses. Nearly a third (29%) of the fourth grade students in Romania had parents with low levels of formal education, as presented in Table 4.14 above. When compared to students with better-educated parents, these students were
more than three times as likely (RR = 3.5) to score in the lower 20 percent of the Romanian reading achievement distribution at the fourth grade.

Further RRP Equity Index analyses examining students with little parental education who attended rural schools found that there was substantial overlap between these two risk factors in Romania. Of the 29 percent of students whose parents had less than secondary education, a large number of them (20% of the overall population) attended rural schools. While these rural students are not explicitly the focus of these analyses, it is an important contextual factor to consider.

Schooling in Romania is mandatory for 10 years, which covers primary and lower-secondary school. Upper-secondary school is optional and enrollment depends on students’ lower-secondary classroom performance and the results of a national exam (Noveanu & Sarivan, 2007). Overall, the net enrollment rate for secondary education (averaged over lower and upper) is around 80 percent (Unicef, 2008), suggesting that a substantial segment of the population (who are also those that tend to do worse in school) does not have access to upper-secondary education.

Research conducted using the PIRLS 2001 data has found that students’ home environment was particularly important for Romanians (Noveanu, Litoiu, & Noveanu, 2007). Noveanu and colleagues (2007) suggested that parents who had the resources to do so were overseeing the learning of their children, which the authors recognized as a well-known Romanian problem of ‘parallel instruction’. Similarly, an OECD review of the Romanian educational system cited a “system of private tutoring for wealthy children
as (an) obvious threat to educational equity while the children of needy families have little chance of attending the best high schools or universities” (OECD, 2000, p. 35). It seems logical that the parents providing this additional instruction are likely to be those with higher levels of education themselves.

Inequitable access to education in rural areas has also been recognized as a problem in the Romanian education system. In particular, school enrollment rates in rural areas are lower than those in urban areas (United Nations Development Program, 2007). Gross enrollment rates in urban areas near 100 percent (97%), whereas less than half of the population may be in school in rural areas (45%). There are efforts underway to remedy these disparities, and rural enrollment rates have increased in recent years (World Bank, 2008). However, this would help explain the high numbers of students with low parental education who are attending rural schools.

Logistic regression models were built to explore the extent to which the disproportionately high risk of lower reading achievement for students with low parental education could be explained by inequity in resources that support reading. Table 4.20 presents the variables included in the logistic regression models for Romania. Interestingly, all of the resource variables that were strongly associated with low reading achievement are related to the home environment. This is consistent with previous research citing the key role of the home environment for Romanian students. Home variables with strong relationships to low reading achievement included books in the home and parents’ estimates of their overall financial status. Consistent with previous
research and the findings in Germany and Iran, having access to books at home was particularly important to reading development. Students who lacked books in the home had nearly five times the risk (RR = 4.9) of scoring in the bottom 20 percent of the Romanian reading achievement distribution relative to their classmates.

Table 4.20 Variables Included in Logistic Regression Models of Reading Achievement Below the National 20th Percentile for Romania

<table>
<thead>
<tr>
<th>Variable Description</th>
<th>Data Provided By</th>
<th>Response Category 1</th>
<th>Response Category 2</th>
<th>Variable Category</th>
<th>Relative Risk for Students in Response Category 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the highest level of education completed by the child’s father (or stepfather or male guardian) and mother (or stepmother or female guardian)?</td>
<td>Parents</td>
<td>Less than secondary education</td>
<td>Secondary education or higher</td>
<td>Student Characteristic</td>
<td>3.5 (0.4)</td>
</tr>
<tr>
<td>Combined Books in the Home</td>
<td>Students and Parents</td>
<td>Low</td>
<td>High</td>
<td>Resource</td>
<td>4.9 (0.7)</td>
</tr>
<tr>
<td>Compared with other families, how well-off do you think your family if financially?</td>
<td>Parents</td>
<td>Not very well off or worse</td>
<td>Average or better</td>
<td>Resource</td>
<td>2.7 (0.3)</td>
</tr>
<tr>
<td>Index of Early Home Literacy Activities (EHLA)</td>
<td>Parents</td>
<td>Medium or Low</td>
<td>High</td>
<td>Resource</td>
<td>2.8 (0.3)</td>
</tr>
<tr>
<td>Parents Reports of Child’s Early Literacy Skills Index</td>
<td>Parents</td>
<td>Not very well or worse</td>
<td>Moderately well or better</td>
<td>Resource</td>
<td>2.7 (0.3)</td>
</tr>
<tr>
<td>In what language did most of the activities in question 2 take place? (early literacy activities)</td>
<td>Parents</td>
<td>Other Language</td>
<td>Language of Test</td>
<td>Resource</td>
<td>3.0 (0.4)</td>
</tr>
</tbody>
</table>

Along with material resources, a number of variables related to students’ early literacy experiences emerged as important risk factors for reading achievement below the national 20th percentile on PIRLS 2006. These included the Index of Early Home Literacy Activities, which is a composite measure of activities done with the child before school, such as reading books and telling stories. This variable had an RR value of 2.8, indicating that students who did such activities infrequently with their parents were nearly three times as likely to be in the lowest 20 percent of readers in Romania at the
fourth grade compared to their peers who had more supportive early literacy environments. In addition to doing early literacy activities, the language they were done in was strongly related to reading achievement. Students who did early literacy activities with their parents in a language other than the language of the test (which in most cases was Romanian) were much more likely (RR = 3.0) than other students to have reading achievement below the national 20th percentile towards the end of primary school.

As one might expect given the relationship between early literacy activities and later reading achievement in Romania, the literacy skills that students entered school with were also strongly associated with reading achievement at the fourth grade. An index variable summarizing parents’ reports of their child’s reading skills (e.g., the ability to recognize letters and read words) upon entering primary school had an RR value of 2.7. This indicates that Romanian students starting school with few literacy skills had nearly three times the risk of other students of having reading achievement below the national 20th percentile once they reached their fourth year of schooling.

Overall, these results show that early literacy experiences and home resources play an important role in literacy development in Romania. It seems plausible that parents who have little education themselves may be lacking necessary skills to provide early literacy support to their children; therefore, students with poorly educated parents may lack important reading development experiences. Through logistic regression, this relationship was examined statistically.
Logistic Regression Model Results for Romania

Table 4.21 presents the logistic regression results of the Base Model and the Extended Model built with Romanian PIRLS 2006 data. The Base Model contained the student risk factor of low parental education as the only predictor of having reading achievement below the national 20th percentile. The Extended Model built on this Base Model by including factors to reduce the impact of parental education as predictors of reading achievement below the national 20th percentile in addition to the parental education variable. The first section of this table presents the overall significance of the Base and Extended Models using an adjusted Wald F test (F = 81.9 and 26.6, respectively), both of which were highly significant (p < .005).
Table 4.21 Results of Logistic Regression Models of Reading Achievement Below the National 20th Percentile for Romania

<table>
<thead>
<tr>
<th>OVERALL MODEL SIGNIFICANCE</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>F</td>
<td>p</td>
</tr>
<tr>
<td>Base Model</td>
<td>81.9</td>
<td>&lt; .005</td>
</tr>
<tr>
<td>Extended Model</td>
<td>26.6</td>
<td>&lt; .005</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VARIABLE COEFFICIENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable Description</td>
</tr>
<tr>
<td>Highest level of education completed by the child’s father (or stepfather or male guardian) and mother (or stepmother or female guardian) is less than secondary education</td>
</tr>
<tr>
<td>Few books at home</td>
</tr>
<tr>
<td>Parents’ report that family is not very well-off financially</td>
</tr>
<tr>
<td>Few early home literacy activities</td>
</tr>
<tr>
<td>Parents’ report that child had few early literacy skills when entering school</td>
</tr>
<tr>
<td>Did early literacy activities in language other than language of test</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RELATIVE RISK AND ODDS RATIO FOR STUDENT RISK FACTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>Base Model</td>
</tr>
<tr>
<td>Extended Model</td>
</tr>
</tbody>
</table>

Focusing on the results of the Base Model, having parents with less than secondary education was a highly significant predictor (p < .005) of being in the bottom 20 percent of reading achievement in Romania, with a coefficient of 1.6. The odds ratio associated with low parental education in the Base Model was 5.1, indicating that students whose parents had less than secondary education had greater than 5 to 1 odds of being a lower achiever in reading compared to students whose parents had more education. The lower bound of this odds ratio estimate (3.6) was far above one, indicating that this result was statistically significant. The relative risk ratio was 3.5—as expected, this was identical to the results of the cross-country analyses, presented in the form of a
logistic regression model. In summary, these results provide a baseline measure of the risk of achievement below the national 20th percentile for students with low parental education.

Building on this baseline, Table 4.21 also presents the results for the Extended Model, which included resource risk factors in addition to parental education as predictors of low reading achievement in the Romanian context. The Extended Model results suggest that differences in resources can explain some, but not all, of the relationship between low parental education and reading achievement. The odds ratio associated with low parental education decreased from 5.1 in the Base Model to 2 in the Extended Model – a statistically significant drop. However, an odds ratio of 2 was still significantly greater than 1, as was the coefficient of 0.7 for this variable (p < .005). This suggests that even if students with low parental education were provided with early literacy support and home resources, they would still have 2 to 1 odds compared to other students of scoring in the bottom 20 percent of fourth graders in reading. Similarly, the relative risk ratio decreased substantially from 3.5 to 1.8, but students whose parents have little formal education still had a significantly higher risk than their classmates of poorer reading skills after statistically controlling for home resources.

Each of the resource variables included in the model made a significant contribution to the prediction of reading achievement below the national 20th percentile, and several of them made larger contributions than that of parental education. The coefficients associated with lacking books in the home (1.1) and doing early literacy
activities in a language different from the language of instruction (1.0) were the largest, indicating the particular importance of these predictors. Overall, these results suggest that reducing the difference in home resources and early literacy experiences could greatly lessen the disproportionate risk of reading achievement below the national 20th percentile for this ‘at risk’ group in Romania, but that parental education may still play an important role in reading achievement beyond what resources can account for.
Chapter 5

Conclusions

Results and Contributions of the Study

Equity is an important issue in education today, and is the focus of much educational policy and research in the United States and around the world (United States Department of Education, 2002; World Conference on Educational for All, 1990). Within this realm, ensuring that all students have the opportunity to learn to read is considered particularly important (Commission of the European Countries, 2008). The value of basic literacy skills to a students’ success in school and later in life cannot be underestimated, and the consequences of not learning how to read at an early age are grim (Berlin & Sum, 1988).

The overarching purpose of this dissertation was to provide an approach to quantifying equity in reading achievement across countries at the fourth grade using IEA’s Progress in International Reading Literacy Study (PIRLS 2006) to present information that would be useful to policymakers and the general public. The following chapter briefly summarizes the results of this endeavor and the implications of these results, as well as suggestions for future research.
Quantifying Equity in Educational Achievement

This dissertation first investigated the myriad of ways that equity in education can be defined and measured in order to find an approach that would be appropriate for a quantitative presentation of equity using PIRLS achievement scores. Based on this review, Berne & Stiefel’s equity framework was employed in this dissertation, because it encompassed many of the ideas that were presented by other researchers while providing definitions of equity that lent themselves to quantitative measurement. In particular, Berne & Stiefel’s concept of horizontal equity of outcomes was emphasized. This is defined as the equal treatment of equals—in this case meaning that all fourth grade students are equally likely to attain basic literacy skills. The extent to which some groups of students were more likely than others to lack such skills, meaning they had very low reading achievement, was considered an indication of inequity. The PIRLS 2006 Low International Benchmark, a point on the PIRLS scale at which students could accomplish very basic reading comprehension tasks, was used as the threshold for low reading achievement.

Using Berne & Stiefel’s framework and the PIRLS 2006 International Benchmarks as a way to conceptualize equity in reading achievement, a series of methods that could be used to quantify equity in achievement were reviewed. To ensure that the measurement approach used in this dissertation would fit within this framework and be suitable for PIRLS data, a series of issues were considered and a set of criteria was developed to evaluate each measurement technique.
First and foremost, the optimal measurement approach needed to provide meaningful results that would be useful to decision-makers. Second, it was necessary to be able to compare across student groups and characteristics because of the strong link between educational outcomes and students’ backgrounds. Third, this dissertation chose to focus on students with the lowest reading skills, because they had the greatest risk for illiteracy. A measurement approach was sought that could center on these students. In addition, because PIRLS 2006 involved such a large number of countries, a technique that allowed for a concise presentation of 40 countries’ data was considered desirable to take full advantage of the cross-country comparisons in this research. The measurement approach also needed to function without the use of an absolute zero, because one does not exist on the PIRLS achievement scale (i.e., one cannot use PIRLS to claim that a student has ‘zero’ reading ability). Finally, a measurement technique was sought that lent itself to further in-depth analysis. This was so that countries could use the summary results as a starting point for further within-country analyses to explore potential reasons for inequities in achievement.

Using these extensive criteria, relative risk ratios were selected as the approach that would be most appropriate for the PIRLS 2006 data and would provide information about equity in reading achievement in the most informative and accessible manner. Relative risk ratios were selected because they provided a concise representation of the relationship between low reading achievement and background characteristics, with a meaningful and intuitive interpretation. Relative risk ratios relied on a dichotomous outcome (e.g., low achievement vs. non-low achievement); therefore, they could be used
with PIRLS achievement scale scores without an absolute zero. The use of a dichotomous outcome also relates relative risk ratios to logistic regression, which allowed for more in-depth explanations of inequities highlighted by cross-country analyses. When applied to the PIRLS 2006 data, the conciseness and interpretability of relative risk ratios made them suitable for a summary of equity in reading achievement across 40 countries, while focusing on those students who are most at risk for low achievement.

Building on the idea of relative risk ratios, the Relative Risk-Percentage (RRP) Equity Index was created as a way to present information about equity in reading achievement internationally. The RRP Equity Index supplemented relative risk ratios by including information about the percentage of students in the ‘at risk’ group, an important factor when making comparisons across countries. Additionally, RRP Equity Index categories were created to provide descriptive information about the level of equity in reading achievement in the PIRLS 2006 countries.

The development of an equity measurement approach that can be used to make comparisons between student groups and across countries can be considered a contribution to the existing body of literature concerning measuring equity in education. The approach used in this dissertation can be particularly useful for policymakers and the research community because it was developed using the PIRLS 2006 international database. No study besides PIRLS provides such high quality and comparable data collected at a single point in time across such a wide range of countries for reading at the primary level. This dissertation capitalized on the wealth of information that such a
unique and well-respected database presents. In addition to the quality assurance that using such renowned data lent to this research, the extensive information available in the PIRLS 2006 international database may also encourage future research to further explore equity issues that were revealed by this dissertation. Similarly, the fact that PIRLS is a trend study that collects data every five years presents unparalleled future opportunities to examine equity in reading achievement internationally at the fourth grade over time.

Such unique information is relevant to a number of policy initiatives around the world. As shown by the literature reviewed for this dissertation, equity in education is often cited as an important goal, but can be difficult to measure quantitatively. These analyses showed that PIRLS 2006 is an ideal vehicle for presenting achievement equity in a quantitative manner, and could be used to measure progress towards equity goals. An example of such an application would be the *European Union’s Lisbon Objectives in Education and Training*. One of the Lisbon objectives aims to decrease the percentage of low achievers in reading in each country by 20 percent. For the 20 European Union countries that participated in PIRLS 2006 and the 21 that are planning to participate in PIRLS 2011, the RRP Equity Index could help inform attempts to work towards this important equity goal.

**Relative Risk of Low Reading Achievement Across Countries**

Relative risk ratios were first applied at the country level, which was referred to as the Global Relative Risk (GRR). Using the GRR, the level of risk associated with attending school in a particular country compared to other PIRLS countries was explored.
These analyses showed that in some parts of the world, the country one lives in can be considered a risk factor for low reading achievement. Students in several countries, including South Africa, Morocco, Kuwait, Qatar, Indonesia, and Iran, were at least three times as likely to have scored below the Low International Benchmark as students in other PIRLS countries. These countries were categorized as having Severe GRR. Similarly, students in Trinidad and Tobago and Macedonia were between two and three times as likely as students in other countries to fall below the Low International Benchmark, and were classified as having Moderate GRR. These results suggest that even if all students within a country had similar outcomes, there may still be issues of equity to consider in a global context. Overall, however, students in most countries had a low risk of failing to meet the Low International Benchmark.

Turning the focus to student groups within each country that are traditionally at risk for low reading achievement, the RRP Equity Index was applied to the PIRLS 2006 data. More specifically, the relative risk of scoring below the PIRLS 2006 Low International Benchmark and the relative risk of scoring in the bottom 20 percent of their country’s achievement distribution was provided. Because of the wide range of countries that participated in PIRLS 2006, the percentage of students scoring below the Low International Benchmark across countries varied substantially. In some countries, too few students scored at this level to produce RRP Equity Index results, while the vast majority of students in other countries fell below this threshold. Therefore, using the Low International Benchmark as a way of identifying ‘at risk’ students was more useful in
some countries than others, and the results for the lower 20 percent of students provided an important complement to the RRP Equity Index results.

Relative risk analyses were conducted for students with low parental education, who spoke a language other than the language of instruction, who attended urban or rural schools, and who were boys. The results of these analyses showed that students with these characteristics were more likely than other fourth grade students to have low reading achievement in a number of the PIRLS 2006 countries. Overall, having parents with less than secondary education and not speaking the language of the test before starting school were associated with inequity in reading achievement in the largest number of PIRLS 2006 countries. In the vast majority of cases, the student groups with an elevated risk for low achievement comprised a minority (less than 50%) of the fourth grade student population.

There were some countries that seemed to have reading achievement inequity for a larger number of student groups than others. In particular, several student groups in Austria, Germany, and the Slovak Republic were at a high risk of lacking reading skills relative to their peers.

Overall, the RRP Equity Index contributes useful information for identifying student groups with disproportionately high risk for illiteracy unless something is done to remedy the situation. Identifying these students is the first step in providing assistance to those in need, and countries may wish to use such information to inform policy decisions. Providing this information in an international context also allows countries to identify
educational systems where there may be different levels of inequity for particular student groups, and encourages countries to learn from what is done in other parts of the world.

As a complement to the RRP Equity Index, the relative risk of scoring in the bottom 20 percent of the national achievement distribution was calculated for each ‘at risk’ student group. In general, these results echoed the patterns revealed by the analyses using the Low International Benchmark. These analyses provided additional information to the PIRLS 2006 countries about their low-achieving fourth grade students, and could be used to further inform policy decisions to improve educational achievement. These results may be particularly useful to countries where a very large or a very small percentage of students scored below the Low International Benchmark.

**Resources Related to Low Reading Achievement in a Subset of Countries**

After identifying students with a disproportionately high risk for low reading achievement, a country may wish to investigate why these students have different outcomes than their classmates. To provide an example of how a country might begin such an investigation, this dissertation conducted logistic regression analyses in three countries—Germany, Iran, and Romania. These analyses focused on a particular ‘at risk’ student group in each country, and explored the extent to which the group’s high risk of poor reading achievement (using the national 20th percentile threshold as a cutpoint) could be explained by differences in resources between this group and other students.
The ‘at risk’ groups that were focused on in each country were urban students in Germany, second language students in Iran, and students with low parental education in Romania. The resources that were strongly related to reading achievement in these analyses seemed consistent with previous research about the ‘at risk’ student group in each country that was examined. While the results were certainly context-specific, books in the home emerged as a resource that was strongly associated with reading achievement in all three countries. This finding was consistent with much of the existing literacy research, and underscores the importance of access to reading materials for literacy development. After statistically controlling for differences in key reading resources, the level of relative risk for the student group examined in each country dropped dramatically. These results suggest that logistic regression may be a useful way to delve deeper into issues of educational inequity, and provides an example to countries of how they may begin to better understand such issues in their schools.

**Suggestions for Future Research**

Using the findings of this dissertation as a foundation, there are several avenues of that could be explored in the future to provide further information about equity in achievement internationally.

The first of these would be to apply relative risk ratios and the RRP Equity Index to a wider range of student background characteristics. Risk factors were chosen for this dissertation that would be policy-relevant for a wide range of countries. However, the PIRLS 2006 international database contains hundreds of other variables that could be
investigated in relation to equity in achievement. Many countries that participated in PIRLS 2006 also collected background information that was particularly relevant for their country’s context, such as ethnicity or school type. Examining equity in reading outcomes for student groups such as these may have more meaning in individual countries or groups of countries. In addition, particular countries may be interested in comparing particular subgroups to other subgroups (instead of the rest of the student population)—for example, comparing urban boys to rural boys. This was not done for this dissertation because of sample size limitations in many countries, but some PIRLS 2006 participants may have sample sizes large enough for such analyses.

It would also be interesting to replicate these analyses using different achievement thresholds. For this research, the Low International Benchmark was selected as a threshold for low reading achievement because it is associated with the most fundamental reading skills measured in the PIRLS assessment. Therefore, it could be used to identify students who were at the greatest risk of illiteracy, and this was complemented with results for the lower 20 percent of students in each country. However, the analyses could be conducted at other PIRLS Benchmarks or other percentiles.

Future research may also investigate the use of different RRP Equity Index categories. For the purposes of this dissertation, RRP Equity Index categories were created that would highlight the most serious incidents of inequity in reading achievement. The cutpoints chosen for these categories were purposefully conservative, so that the countries that were highlighted with Severe or Moderate Risk would have little
reason to doubt the gravity of such a classification. However, other cutpoints could be explored. For example, being classified as a Moderate Risk for this dissertation meant that students were twice as likely as their peers to have low reading achievement (RR = 2.0). However, one could make an argument that an RR value of 1.5 is also worth highlighting as an equity concern. Similarly, when 50 percent or more of the students were in the ‘at risk’ group, this was considered a high percentage (placing countries in the SRP or MRP category). However, there were no countries that fell into the SRP category, and this dissertation found that most cases of inequity impacted a minority of students (less than 50%). Therefore, it may be worth noting instances when the ‘at risk’ group comprises a substantial minority of students—for example, 35 percent of the student population may be considered a high percentage.

Finally, future research could apply this approach to measuring equity in educational achievement to other IEA datasets, such as the Trends in Mathematics and Science Study (TIMSS) and other cycles of PIRLS. These additional analyses could provide important information about equity across subject areas, at different grade levels, and over time for a wide range of countries. In particular, such analyses could be used in the upcoming 2011 cycle of TIMSS and PIRLS.
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Appendix A

Sample PIRLS 2006 Passages and Items

Informational Passage: Antarctica
Antarctica: Land of Ice

Introducing Antarctica

What is Antarctica?
Antarctica is a continent that is right at the south of the planet. (If you try to find it on a globe, you will see that it is at the bottom.)

It takes up one-tenth of the Earth’s surface and is covered with a blanket of ice that can be as thick as 1,500 metres or more. The South Pole is right in the middle of Antarctica.

Antarctica is the coldest continent, as well as the driest, the highest and the windiest. Very few people live there all year round. Scientists stay there for short periods, living in specially built research stations.

Summer in Antarctica is between October and March. During this time there is non-stop daylight. In winter, April to September, the opposite happens and Antarctica is plunged into six months of constant darkness.
In Antarctica, it is colder than you can possibly imagine, even in the summer! The South Pole is the coldest part of Antarctica. The average temperature for January, the middle of the summer, is minus 28 degrees Celsius (written as -28°C). Minus means colder than the freezing point, which is 0°C.

In the winter, April to September, the average temperature at the South Pole can be as cold as -89°C. When it is that cold, a mug of boiling water thrown in the air would freeze before it hit the ice. Sometimes the scientists have to use fridges to keep their samples warm!

Penguins in Antarctica

There are more penguins in the Antarctic than any other bird.

They cannot fly but use their short wings as swimming flippers. They are superb swimmers. On land, they waddle upright or move in short hops.

Penguins have many feathers that overlap each other. These, together with woolly down feathers and a thick layer of fat, keep out the cold air, wind and water. For extra warmth, penguins huddle together in groups.
A Letter from Antarctica

Sara Wheeler is one of the scientists working in Antarctica. By reading her letter to her nephew Daniel, you can learn more about her Antarctic experience.

Antarctica
Friday, 9 December

Dear Daniel,

Here is the letter I promised to write to you from Antarctica, and a photograph. Imagine how excited I am to be here at last, following in the footsteps of so many famous explorers. It is very different from the world I am used to.

There is nothing fresh down here—and no supermarkets—so we have to eat a lot of dried, tinned or frozen food (it doesn’t have to be put in the freezer—you can just leave it outside). We cook on small gas stoves, which take much longer than cookers at home. Yesterday I made noodles with tomato paste and vegetables out of a tin, followed by dried strawberries that tasted like cardboard.

I miss fresh apples and oranges—I wish you could send me some!

Love from Sara
Questions  Antarctica: Land of Ice

1. Where can you find Antarctica on a globe?

2. Antarctica is the coldest place on Earth. What other records does it hold?
   - [ ] A  driest and cloudiest
   - [x] B  wettest and windiest
   - [ ] C  windiest and driest
   - [ ] D  cloudiest and highest

3. What is the coldest part of Antarctica?

   - [x] Correct answer
4. Think about what the article says about Antarctica. Give two reasons why most people who visit Antarctica choose not to go there between April and September.

1. 

2. 

5. Why does the article tell you that ‘a mug of boiling water thrown in the air would freeze before it hit the ice’?

- A to tell you how hot the water is in Antarctica
- B to show you what they drink in Antarctica
- C to tell you about scientists’ jobs in Antarctica
- D to show you how cold it is in Antarctica

6. According to the article, what do penguins use their wings for?

- A flying
- B *swimming
- C keeping chicks warm
- D walking upright

* Correct answer
7. Give three ways penguins are able to keep warm in Antarctica.

1.

2.

3.

8. What are two things you learn about food in Antarctica from Sara’s letter?

1.

2.
9. Think about whether you would like to visit Antarctica. Use what you have read in both *Introducing Antarctica* and *A Letter from Antarctica* to explain why you would or would not like to visit.

   __________________________________________________________________________
   __________________________________________________________________________
   __________________________________________________________________________
   __________________________________________________________________________

10. Which section of the article tells you how thick the ice is in Antarctica?

   ✶ (A) What is Antarctica?
   (B) The Weather in Antarctica
   (C) Penguins in Antarctica
   (D) A Letter from Antarctica

   ✶ Correct answer
11. In this article, there are two different ways of finding out about Antarctica:

- *Introducing Antarctica*
- *A Letter from Antarctica*

Which of these kinds of information do you find more interesting, and why?

________________________________________

________________________________________
Antarctica, Item 1

Where can you find Antarctica on a globe?

Process: Focus on and retrieve explicitly stated information and ideas.

1 – Acceptable Response
These responses identify the explicitly stated location of Antarctica. The response states that Antarctica is at the bottom of the globe, or describes it as being at the south of the planet.

Example:
It is plunged into six months of constant darkness. A mug of boiling water thrown in the air would freeze before it hit the ice.

1 – Partial Comprehension
These responses demonstrate partial comprehension by interpreting information about one condition in Antarctica during the winter. The response describes one of the winter conditions mentioned in the article: 1) the extreme cold OR 2) the constant darkness. (Note: It is not correct to just say that it is winter; it is necessary for the response to include the extreme cold or darkness of winter.)

Example:
It is very cold that time of year.

Antarctica, Item 3

What is the coldest part of Antarctica?

Process: Focus on and retrieve explicitly stated information and ideas.

1 – Acceptable Response
These responses identify the explicitly stated location of the coldest part of Antarctica. The response states that the South Pole is the coldest part. (*The middle part* is also acceptable.)

Antarctica, Item 4

Think about what the article says about Antarctica. Give two reasons why most people who visit Antarctica choose not to go there between April and September.

Process: Interpret and integrate ideas and information.

2 – Complete Comprehension
These responses demonstrate complete comprehension by interpreting information about conditions in Antarctica during the winter. The response describes both of the winter conditions mentioned in the article: 1) the extreme cold, and 2) the constant darkness. (Note: It is not correct to just say that it is winter; it is necessary for the response to include the extreme cold or darkness of winter.)

Example:
It is plunged into six months of constant darkness. A mug of boiling water thrown in the air would freeze before it hit the ice.

3 – Extensive Comprehension
These responses demonstrate extensive comprehension by identifying most of the ideas in the article from which penguins’ ability to stay warm can be inferred. The response describes at least three of the ways penguins are able to stay warm listed below.

2 – Satisfactory Comprehension
These responses demonstrate satisfactory comprehension by identifying some of the ideas in the article from which penguins’ ability to stay warm can be inferred. The response describes two of the ways penguins are able to stay warm listed below.

1 – Minimal Comprehension
These responses demonstrate limited comprehension by identifying one idea in the
article from which penguins' ability to stay warm can be inferred. The response describes only one of the ways penguins are able to stay warm listed below.

Ideas from Article Explaining how Penguins Stay Warm

They have many feathers which overlap each other.
They have woolly down feathers.
They have feathers (only counts as a separate idea if neither of the first two ideas about feathers is included in the response).
They have a thick layer of fat.
They huddle together in groups.

They eat noodles with tomato paste and vegetables.
Strawberries taste like cardboard.
They don't have apples and oranges.
Sara doesn't like the food in Antarctica. /It is not good.

Antarctica, Item 8

What are two things you learn about food in Antarctica from Sara's letter?

Process: Focus on and retrieve explicitly stated information and ideas

2 – Complete Comprehension
These responses demonstrate complete comprehension by identifying two explicitly stated ideas related to food in Antarctica. The response identifies at least two of the ideas listed below.

1 – Partial Comprehension
These responses demonstrate partial comprehension by identifying one explicitly stated idea related to food in Antarctica. The response identifies only one of the ideas listed below.

Ideas from Sara’s Letter About Food in Antarctica

There are no supermarkets.
There is a lot of dried, frozen or frozen food (one or more of these adjectives is acceptable as an idea). /Nothing is fresh.
Food doesn't have to be put in a freezer. /Food can be left outside.
They cook on gas stoves.
It takes longer to cook.

Antarctica, Item 9

Think about whether you would like to visit Antarctica. Use what you have read in both Introducing Antarctica and A Letter from Antarctica to explain why you would or would not like to visit.

Process: Interpret and integrate ideas and information

2 – Complete Comprehension
These responses demonstrate complete comprehension by integrating information from across two different texts to fully support a personal opinion about text content. The response states or implies a personal opinion about visiting Antarctica and provides specific information from both texts—Introducing Antarctica and A Letter from Antarctica—to support the opinion. See chart below for appropriate ideas for each text.

Example:
No, because it is the coldest place on earth and there is nothing fresh to eat.

1 – Partial Comprehension
These responses demonstrate partial comprehension by supporting a personal opinion about text content with information from one text. The response states or implies a personal opinion about visiting Antarctica and provides specific information from one text—Introducing Antarctica or A Letter from Antarctica—to support the opinion. See chart below for appropriate ideas for each text.

Example:
Yes, because many explorers have been there.
**Topics/Ideas from Each Text that May be Used to Support Opinion**

**Introducing Antarctica**
- Extreme cold
- Constant darkness
- Penguins live there
- Few people live there
- Scientists stay there

**A Letter from Antarctica**
- Food (freshness, tinned/dried, cooking, buying)
- Cold
- Famous explorers have been there

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**Antarctica, Item 11**

In this article, there are two different ways of finding out about Antarctica: Introducing Antarctica

A Letter from Antarctica

Which of these kinds of information do you find more interesting, and why?

**Process:** Examine and evaluate content, language, and textual elements

**1 - Acceptable Response**

These responses demonstrate understanding of the type of information presented in at least one or two texts. The response provides an opinion about which text is most interesting. In addition, it includes an explanation that accurately describes some element of the content, language, format, or tone of at least one of the texts.

**Example**

Sara's letter because it makes you understand what it really feels like to be there.
Literary Passage: Little Lump of Clay
The Little Lump of Clay

by Diana Engel

Way up high, in an old tower, there was a workshop. It was a pottery workshop, filled with barrels of colourful glazes, potter's wheels, kilns and, of course, clay. Near the window stood a big wooden bin with a heavy lid. There the clay was kept. Way at the bottom, squashed into the corner, was the oldest lump of clay. He barely remembered the last time he had been handled, a long time ago. Every day the heavy lid would open. Hands reached in, quickly grabbing bags or balls of clay. The little lump of clay could hear the cheerful sounds of people busy at their work.

"When will it be my turn?" he wondered. As each day passed in the darkness of the bin, the little lump of clay lost hope.

One day a large group of children came into the workshop with their teacher. Many hands reached into the bin. The little lump of clay was the last to be chosen, but he was out!

"Here's my big chance!" he thought, squinting in the light.

A boy put the clay on the potter's wheel, spinning it as fast as he could. "This is fun!" thought the little lump of clay. The boy tried pulling the clay up as the wheel went around. The little lump of clay felt the excitement of becoming something! After trying to make a bowl, the boy gave up. He pushed and pounded the clay into a neat ball.

"Time to clean up," said the teacher. The workshop was filled with the sounds of children sponging and wiping and washing and drying. Water dripped everywhere.

The boy plopped the lump of clay near the window and rushed to join his friends. After a while, the workshop emptied. The room was quiet and dark. The little lump of clay was terrified. Not only did he miss the moistness of the bin, he knew he was in danger.

"It's all over," he thought. "I'll just sit here and dry out until I'm as hard as a rock."
He sat by the open window, unable to move, feeling the moisture seep out of him. The sunlight beat down, the night breezes blew in, until he was rock hard. He was so hard he could hardly think. He only knew that he was filled with hopelessness.

But somewhere deep inside the little lump of clay, a tiny drop of moisture was left, and he refused to let it go.

“Rain,” he thought.
“Water,” he sighed.
“Please,” he finally squeezed out of his dry hopeless self.

A passing cloud took pity on the little lump of clay, and a wonderful thing happened. Huge raindrops hammered through the open window, falling on the little lump of clay. All night it rained, and by morning he was as soft as his old self.

Voices drifted into the workshop.

“Oh no,” said a woman. She was a potter who often used the workshop.

“Someone has left the window open all weekend! We’ve got a mess to clean up. You can work with some clay while I find the towels,” she said to her daughter.

The little girl saw the lump of clay sitting at the window.

“This looks like a perfect lump for me,” she said.

Soon she was pressing and kneading the clay into pleasing shapes. To the little lump of clay, her fingers felt heavenly.

The girl thought as she worked, and her hands moved with purpose. The little lump of clay felt himself being gently pushed into a rounded, hollow shape. A few pinches, and he had a handle.
“Mommy, Mommy,” called the girl, “I made a cup!”

“It’s wonderful!” said her mother. “Put it on the shelf and it will be fired in the kiln. Then you can glaze it any colour you like.”

Soon the little cup was ready to be taken to his new home. Now he lives on a shelf in the kitchen, next to the other cups and saucers and mugs. They are all very different and some are very beautiful.

“Breakfast!” calls the mother, setting the new cup on the table and filling him with hot chocolate.

The little girl holds him gently. How happy he feels with the smooth lines of his new shape. How well he does his job!

The little cup sits proudly. “At last—at last I am something.”
Questions  The Little Lump of Clay

1. Number the sentences below in the order the events happened in the story. Number 1 has been done for you.

   ____ The rain made the lump of clay moist and soft.
   ____ A boy tried to make the lump of clay into a bowl.
   ____ A girl made the lump of clay into a cup.
   ____ The lump of clay dried out.
   ____ The lump of clay was in the bin.

2. Why was the lump of clay in the bin for such a long time?

   [space for response]

3. At the beginning of the story, what did the lump of clay wish for?

   [space for response]
4. Why was the clay eventually taken out of the bin?
   * A. All the other lumps of clay were used.
   B. It was on top of the other lumps of clay.
   C. The boy chose that lump because he especially liked it.
   D. The teacher told the boy to use that lump.

5. What did the boy do that was careless?
   A. He left the clay on the potter’s wheel.
   B. He was spinning the wheel as fast as he could.
   * C. He put the clay near the window.
   D. He pushed and pounded the clay.

6. The boy left the lump of clay in danger. What was the danger?

   __________________________________________________________________________
   __________________________________________________________________________

   * Correct answer
7. How did the lump of clay feel right after the boy left the pottery workshop?

* a satisfied

b scared

c angry

d proud

8. What wonderful thing happened after the lump of clay had been lying by the window for a long time? Why was this so wonderful for the lump of clay?

* Correct answer
9. Which words in the story show that the little girl knew what she wanted to make?

- A  ‘her fingers felt heavenly.’
- B  ‘The little girl saw the lump of clay.’
- ✗ C  ‘The little girl holds him gently.’
- D  ‘her hands moved with purpose.’

10. Describe the different feelings the clay had at the beginning and the end of the story. Explain why his feelings changed.

Correct answer
11. The little girl is an important person in this story. Explain why she was important to what happened.

12. The author of the story writes about the lump of clay as if it were a person. What is the author trying to make you imagine?
   
   A. what it is like in the rain
   B. how a lump of clay might feel
   C. what it is like to work with clay
   D. how it feels to make something

13. What is the main message of this story?
   
   A. People are easy to knead and shape like clay.
   B. There is a great deal of unhappiness in the world.
   C. Everything is happiest when it finds a purpose.
   D. Pottery is the best way to do good in the world.

   Correct answer

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Clay, Item 1

Number the sentences below in the order the events happened in the story. Number 1 has been done for you.

1. The lump of clay was in the bin.
2. The rain made the lump of clay moist and soft.
3. A boy tried to make the lump of clay into a bowl.
4. A girl made the lump of clay into a cup.
5. The lump of clay dried out.

Sample:
Because he was at the bottom.

Clay, Item 2

Why was the lump of clay in the bin for such a long time?

Process: Make straightforward inferences

Clay, Item 3

At the beginning of the story, what did the lump of clay wish for?

Process: Make straightforward inferences

1 – Acceptable Response

These responses provide an appropriate inference for the lump of clay’s initial predicament. The response demonstrates understanding that the lump of clay was not as accessible as the other clay. It may focus on the fact that it was at the bottom or in a corner of the bin.

Example:
Because people used the other clay.

1 – Acceptable Response

These responses provide an appropriate inference for the lump of clay’s feelings at the beginning of the story. The response demonstrates understanding that the lump of clay wanted to be used like the other clay in the bin (its short-term wish).

Example:
To be chosen.

Or, the response may focus on the outcomes of being used like the other clay (its long-term wish) and having a purpose or use, or having a sense of fulfillment.

Example:
To be made into an object and used a lot.
Clay, Item 6

The boy left the lump of clay in danger. What was the danger?

Process: Interpret and integrate ideas and information

1 – Acceptable Response
These responses integrate ideas in the story to interpret the nature of the lump of clay’s danger. The response demonstrates understanding that the lump of clay was in danger of drying out or becoming hard. (It is acceptable if the student’s interpretation is that the clay is in danger of dying.)

Example:
The lump of clay’s danger was that he might dry out.

Clay, Item 10

Describe the different feelings the clay had at the beginning and the end of the story. Explain why his feelings changed.

Process: Interpret and integrate ideas and information

3 – Extensive Comprehension
These responses demonstrate extensive comprehension by integrating ideas from across the text to fully support an interpretation of why the clay’s feelings changed during the story. The response provides an appropriate description of the clay’s feelings at the beginning and at the end. It includes information from the story to explain why they changed. In the explanation the response demonstrates understanding of one of the following aspects of the clay’s proud feelings about itself at the end of the story: fulfillment, usefulness, or beauty/aesthetics. See examples in chart below.

Example:
At the beginning the clay was sad. At the end he felt proud because he had become a cup.

2 – Satisfactory Comprehension
These responses demonstrate satisfactory comprehension by integrating ideas from across the text to support an interpretation of why the clay’s feelings changed during the story. The response provides an appropriate description of the clay’s feelings at the beginning and at the end. It includes information from the story to explain why they changed. However, the explanation for why they changed does not demonstrate understanding of one of the following aspects of the clay’s proud feelings about itself at the end of the story: fulfillment, usefulness, or beauty/aesthetics.

1 – Partial Comprehension
These responses demonstrate partial comprehension of events in the story related to the lump of clay’s recovery. The response describes the wonderful thing that happened as rain coming through the window, or as the clay becoming wet or soft again. However, the response does not make a connection between the rain and its physical effect on the clay.

Example:
It made it go really soft.
Example:

He was sad in the beginning. But he was happy in the end because of what the girl did.

Or, the response provides an appropriate explanation of his feelings at the beginning or the end (but not both) and in the explanation of that feeling demonstrates understanding of one of the following aspects of the clay’s proud feelings about itself at the end: fulfillment, usefulness, or beauty/aesthetics (see examples in chart below).

Example:

He is happy because he has been made into something, he is proud of his shape and he is proud of sitting on the shelf with all the other mugs.

1 – Minimal Comprehension

These responses demonstrate limited comprehension of how the clay’s feelings changed during the story. The response provides an appropriate description of the clay’s feelings at the beginning or at the end, or both, but does not include appropriate information from the story to explain why they changed.

Example:

He was sad in the beginning. But he was happy in the end.

Or, the response provides an explanation of the change that demonstrates feelings of fulfillment, usefulness, or aesthetics, but does not describe his feelings at the beginning or the end.

Example:

He became something useful.

Explanations that Support the Clay’s Feelings of Pride at End of Story: Examples

The following examples represent some of the different ways students may support the clay’s feelings of pride at the end of the story.

Fulfillment

The girl made him into something.
He had become something.

Usefulness

He had a job to do.

He became a cup.
People could use him.
He was something useful.

Beauty/Aesthetic

The girl made him beautiful.
He liked his new shape.

Clay, Item 11

The little girl is an important person in this story. Explain why she was important to what happened.

Process: Interpret and Integrate Ideas and Information

2 – Complete Comprehension

These responses demonstrate complete comprehension of the story’s supporting character by integrating ideas from across the text to interpret the character’s significance to the story’s outcome. The response explains the little girl’s central role as the facilitator of the clay’s change and addresses how her role contributes to the theme of fulfillment.

Example:

She made the clay into something beautiful.

1 – Partial Comprehension

These responses demonstrate partial comprehension of the supporting character’s significance in the story. The response identifies the central action of the little girl as the facilitator of the clay’s change but does not address the theme of fulfillment.

Example:

She was the one who made the clay into a cup.
Appendix B

PIRLS 2006 International Benchmarks

Low International Benchmark (400)

When reading literary texts, students can:

- Recognize an explicitly stated detail
- Locate a specified part of the story and make an inference clearly suggested by the text.

When reading information texts, students can:

- Locate and reproduce explicitly stated information that is readily accessible, for example, at the beginning of the text or in a clearly defined section
- Begin to provide a straightforward inference clearly suggested by the text.
Intermediate International Benchmark (475)

When reading literary texts, students can:

- Identify central events, plot sequences, and relevant story details
- Make straightforward inferences about the attributes, feelings, and motivations of main characters
- Begin to make connections across parts of the text

When reading information texts, students can:

- Locate and reproduce one or two pieces of information from within the text
- Make straightforward inferences to provide information from a single part of the text
- Use subheadings, textboxes, and illustrations to locate parts of the text
High International Benchmark (550)

When reading literary texts, students can:

- Locate relevant episodes and distinguish significant details embedded across the text
- Make inferences to explain relationships between intentions, actions, events, and feelings, and give text-based support
- Recognize the use of some textual features (e.g., figurative language, an abstract message)
- Begin to interpret and integrate story events and character actions across the text

When reading information texts, students can:

- Recognize and use a variety of organizational features to locate and distinguish relevant information
- Make inferences based on abstract or embedded information
- Integrate information across a text to recognize main ideas and provide explanations
- Compare and evaluate parts of a text to give a preference and a reason for it
- Begin to understand textual elements, such as simple metaphors and author’s point of view
Advanced International Benchmark (625)

When reading literary texts, students can:

- Integrate ideas across a text to provide interpretation of a character’s traits, intentions, and feelings, and provide full text-based support
- Interpret figurative language
- Begin to examine and evaluate story structure

When reading information texts, students can:

- Distinguish and interpret complex information from different parts of text, and provide full text-based support
- Understand the function of organizational features
- Integrate information across a text to sequence activities and fully justify preferences
Appendix C

PIRLS 2006 Background Variables Included in Analyses
<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>Question Location</th>
<th>Description</th>
<th>Variable Name</th>
<th>Category 1</th>
<th>Category 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOME</td>
<td>SH1-02A</td>
<td>Before your child began ISCED Level 1, how often did you or someone else in your home read books with him or her?</td>
<td>ASBHHHA01</td>
<td>Sometimes or Never</td>
<td>Often</td>
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<tr>
<td>HOME</td>
<td>SH1-02B</td>
<td>Before your child began ISCED Level 1, how often did you or someone else in your home tell stories with him or her?</td>
<td>ASBHHHA02</td>
<td>Sometimes or Never</td>
<td>Often</td>
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<tr>
<td>HOME</td>
<td>SH1-02C</td>
<td>Before your child began ISCED Level 1, how often did you or someone else in your home sing songs with him or her?</td>
<td>ASBHHHA03</td>
<td>Sometimes or Never</td>
<td>Often</td>
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<td>SH1-02D</td>
<td>Before your child began ISCED Level 1, how often did you or someone else in your home play with alphabet toys with him or her?</td>
<td>ASBHHHA04</td>
<td>Sometimes or Never</td>
<td>Often</td>
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<td>HOME</td>
<td>SH1-02E</td>
<td>Before your child began ISCED Level 1, how often did you or someone else in your home talk about things you had done with him or her?</td>
<td>ASBHHHA05</td>
<td>Sometimes or Never</td>
<td>Often</td>
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<td>HOME</td>
<td>SH1-02F</td>
<td>Before your child began ISCED Level 1, how often did you or someone else in your home talk about what you had read with him or her?</td>
<td>ASBHHHA06</td>
<td>Sometimes or Never</td>
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<tr>
<td>HOME</td>
<td>SH1-02G</td>
<td>Before your child began ISCED Level 1, how often did you or someone else in your home play word games with him or her?</td>
<td>ASBHHHA07</td>
<td>Sometimes or Never</td>
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<td>Before your child began ISCED Level 1, how often did you or someone else in your home write letters or words with him or her?</td>
<td>ASBHHHA08</td>
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<td>Before your child began ISCED Level 1, how often did you or someone else in your home read aloud signs and labels with him or her?</td>
<td>ASBHHHA09</td>
<td>Sometimes or Never</td>
<td>Often</td>
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<td>SH1-02J</td>
<td>Before your child began ISCED Level 1, how often did you or someone else in your home visit a library with him or her?</td>
<td>ASBHHHA10</td>
<td>Sometimes or Never</td>
<td>Often</td>
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<td>In what language did most of the activities in question 2 take place?</td>
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<td>Language of test</td>
<td>Other language</td>
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<td>What language did your child speak before he/she began school?</td>
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<td>Yes</td>
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<td>Did your child attend ISCED Level 0?</td>
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<td>How well could your child recognize most of the letters of the alphabet when he/she began ISCED Level 1?</td>
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<td>SH1-07B</td>
<td>How well could your child read some words when he/she began ISCED Level 1?</td>
<td>ASBHAIB2</td>
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<td>Moderately well or better</td>
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<td>How well could your child read sentences when he/she began ISCED Level 1?</td>
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<td>Not very well or worse</td>
<td>Moderately well or better</td>
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<td>SH1-07D</td>
<td>How well could your child write letters of the alphabet when he/she began ISCED Level 1?</td>
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<td>Not very well or worse</td>
<td>Moderately well or better</td>
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<td>SH1-08A</td>
<td>How often do you or someone else in your home listen to your child read aloud?</td>
<td>ASBHDOT1</td>
<td>Less than once a week</td>
<td>At least once a week</td>
</tr>
<tr>
<td>PIRLS 2006 Questionnaire</td>
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<tr>
<td>HOME</td>
<td>SH1-08B</td>
<td>How often do you or someone else in your home talk with your child about things you have done?</td>
<td>ASBHDOT2</td>
<td>Less than once a week</td>
<td>At least once a week</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-08C</td>
<td>How often do you or someone else in your talk with your child about what he/she is read on his/her own?</td>
<td>ASBHDOT3</td>
<td>Less than once a week</td>
<td>At least once a week</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-08D</td>
<td>How often do you or someone else in your home discuss your child's classroom reading work with him/her?</td>
<td>ASBHDOT4</td>
<td>Less than once a week</td>
<td>At least once a week</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-08E</td>
<td>How often do you or someone else in your home go to the library or a bookstore with your child?</td>
<td>ASBHDOT5</td>
<td>Less than once a week</td>
<td>At least once a week</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-08F</td>
<td>How often do you or someone else in your home help your child with reading for school?</td>
<td>ASBHDOT6</td>
<td>Less than once a week</td>
<td>At least once a week</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-09</td>
<td>In what language did most of the activities in question 8 take place?</td>
<td>ASBHACTL</td>
<td>Language of test</td>
<td>Other language</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-11A</td>
<td>Do you think your child's school makes an effort to include you in your child's education?</td>
<td>ASBHTAC1</td>
<td>Disagree</td>
<td>Agree</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-11B</td>
<td>Do you think your child's school should make greater effort to include you in your child's education?</td>
<td>ASBHTAC2</td>
<td>Agree</td>
<td>Disagree</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-11C</td>
<td>Do you think your child's school cares about your child's progress in school?</td>
<td>ASBHTAC3</td>
<td>Disagree</td>
<td>Agree</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-11D</td>
<td>Do you think your child's school does a good job in helping your child become a better reader?</td>
<td>ASBHTAC4</td>
<td>Disagree</td>
<td>Agree</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-12</td>
<td>In a typical week, how much time do you usually spend reading for yourself at home including books, magazines, newspapers, and materials for work?</td>
<td>ASBHREAD</td>
<td>Less than 1 hour</td>
<td>1 hour or more</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-13</td>
<td>When you are at home, how often do you read for enjoyment?</td>
<td>ASBHRRE</td>
<td>Less than once a week</td>
<td>At least once a week</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-14A</td>
<td>How much do you agree that you only read if you have to?</td>
<td>ASBHSTM1</td>
<td>Agree</td>
<td>Disagree</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-14B</td>
<td>How much do you agree that you like talking about books with other people?</td>
<td>ASBHSTM2</td>
<td>Disagree</td>
<td>Agree</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-14C</td>
<td>How much do you agree that you like to spend your spare time reading?</td>
<td>ASBHSTM3</td>
<td>Disagree</td>
<td>Agree</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-14D</td>
<td>How much do you agree that you read only if you need information?</td>
<td>ASBHSTM4</td>
<td>Agree</td>
<td>Disagree</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-14E</td>
<td>How much do you agree that reading is an important activity in your home?</td>
<td>ASBHSTM5</td>
<td>Disagree</td>
<td>Agree</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-15</td>
<td>About how many books are there in your home?</td>
<td>ASBHBOOK</td>
<td>25 or fewer</td>
<td>More than 25</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-16A</td>
<td>About how many children's books are there in your home?</td>
<td>ASBHCHBK</td>
<td>25 or fewer</td>
<td>More than 25</td>
</tr>
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<tr>
<td>HOME</td>
<td>SH1-16B</td>
<td>Are these books mainly in &lt;language of test&gt;?</td>
<td>ASBHCHBL</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-17A</td>
<td>When talking at home with your child, what language does the child's father us most often?</td>
<td>ASBHLAHF</td>
<td>Other Language</td>
<td>Language of Test</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-17B</td>
<td>When talking at home with your child, what language does the child's mother us most often?</td>
<td>ASBHLAHM</td>
<td>Other Language</td>
<td>Language of Test</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-18A</td>
<td>What is the highest level of education completed by the child's father/stepfather/male guardian?</td>
<td>ASBHLEDF</td>
<td>Less than upper-secondary</td>
<td>Upper-secondary or higher</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-18B</td>
<td>What is the highest level of education completed by the child's mother/stepmother/female guardian?</td>
<td>ASBHLEDM</td>
<td>Less than upper-secondary</td>
<td>Upper-secondary or higher</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-19A</td>
<td>What best describes the employment situation of the child's father/stepfather/male guardian?</td>
<td>ASBHEMPF</td>
<td>Less than full time</td>
<td>Full time</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-19B</td>
<td>What best describes the employment situation of the child's mother/stepmother/female guardian?</td>
<td>ASBHEMPM</td>
<td>Less than full time</td>
<td>Full time</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-20A</td>
<td>What kind of work does the child's father/stepfather/male guardian do for his main job?</td>
<td>ASBHMJF</td>
<td>Non-professional or doesn't work (fishery, craft, machine operator)</td>
<td>Professional (e.g. business owner, clerk, service wkr, corporate)</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-20B</td>
<td>What kind of work does the child's mother/stepmother/female guardian do for her main job?</td>
<td>ASBHMJM</td>
<td>Non-professional or doesn't work (fishery, craft, machine operator)</td>
<td>Professional (e.g. business owner, clerk, service wkr, corporate)</td>
</tr>
<tr>
<td>HOME</td>
<td>SH1-21</td>
<td>Compared with other families, how well-off do you think your family if financially?</td>
<td>ASBHWELL</td>
<td>Not very well off or worse</td>
<td>Average or better</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-04</td>
<td>How would you characterize the area in which your school is located?</td>
<td>ACBGCOMM</td>
<td>Urban</td>
<td>Rural or suburban</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-04</td>
<td>How would you characterize the area in which your school is located?</td>
<td>ACBGCOM2</td>
<td>Rural</td>
<td>Urban or suburban</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-05</td>
<td>For the &lt;fourth-grade&gt; students in your school, about how many students receive free or reduced-price lunch?</td>
<td>ACBGLUN</td>
<td>All</td>
<td>Some or None</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-06A</td>
<td>Approximately what percentage of students in your school come from economically disadvantaged homes?</td>
<td>ACBGPST1</td>
<td>More than 50%</td>
<td>50% or less</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-06B</td>
<td>Approximately what percentage of students in your school come from economically affluent homes?</td>
<td>ACBGPST2</td>
<td>50% or less</td>
<td>More than 50%</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-06C</td>
<td>Approximately what percentage of students in your school receive instruction in their home language (not &lt;language of the test&gt;) for at least part of the day?</td>
<td>ACBGPST3</td>
<td>More than 50%</td>
<td>50% or less</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-06D</td>
<td>Approximately what percentage of grades 1-4 students in your school do not speak &lt;language of the test&gt; as their first language?</td>
<td>ACBGPST4</td>
<td>More than 50%</td>
<td>50% or less</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-08A</td>
<td>Does your school offer the following for the &lt;fourth-grade&gt; student in your school? (extended instructional time)</td>
<td>ACBGOFIT</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-08A1</td>
<td>(If yes to 08a)...How many students participate?</td>
<td>ACBGOFI1</td>
<td>More than 50%</td>
<td>50% or less</td>
</tr>
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<td>SCHOOL</td>
<td>CG1-08B</td>
<td>Does your school offer the following for the &lt;fourth-grade&gt; student in your school? (before or after school child care)</td>
<td>ACBGOFCC</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-08B1</td>
<td>(If yes to 08b)...How many students participate?</td>
<td>ACBGOFC1</td>
<td>50% or less</td>
<td>More than 50%</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-09A</td>
<td>About how many of the students in your school can recognize most of the letters of the alphabet when they begin &lt;first year of formal schooling&gt;?.</td>
<td>ACBG1GR1</td>
<td>50% or less</td>
<td>More than 50%</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-09B</td>
<td>About how many of the students in your school can read some words when they begin &lt;first year of formal schooling&gt;?.</td>
<td>ACBG1GR2</td>
<td>50% or less</td>
<td>More than 50%</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-09C</td>
<td>About how many of the students in your school can read sentences when they begin &lt;first year of formal schooling&gt;?.</td>
<td>ACBG1GR3</td>
<td>50% or less</td>
<td>More than 50%</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-09D</td>
<td>About how many of the students in your school can write letters of the alphabet when they begin &lt;first year of formal schooling&gt;?.</td>
<td>ACBG1GR4</td>
<td>50% or less</td>
<td>More than 50%</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-09E</td>
<td>About how many of the students in your school can write some words when they begin &lt;first year of formal schooling&gt;?.</td>
<td>ACBG1GR5</td>
<td>50% or less</td>
<td>More than 50%</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-10A</td>
<td>Compared with other areas of the curriculum, how much emphasis does your school place on teaching reading skills to students in grades &lt;1-4&gt;?</td>
<td>ACBGACU1</td>
<td>Same or less emphasis</td>
<td>More emphasis</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-11A</td>
<td>Does your school have its own written statement of reading curriculum to be taught in the school (in addition to the national or regional curriculum guides)?</td>
<td>ACBGRWS</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-11B</td>
<td>Does your school have informal initiatives to encourage reading among students (book clubs, independent reading contests, school-wide recreational reading periods)?</td>
<td>ACBGRII</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-11B</td>
<td>Does your school have informal initiatives to encourage reading among students (book clubs, independent reading contests, school-wide recreational reading periods)?</td>
<td>ACBGRII</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-11C</td>
<td>Does your school have school-based programs for teachers geared towards the improvement of reading instruction?</td>
<td>ACBGRSP</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-11D</td>
<td>Does your school have a policy to coordinate reading instruction across &lt;fourth grade and below&gt;?</td>
<td>ACBGRGL</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-14</td>
<td>For students in &lt;fourth grade and below&gt;, does your school make provisions for reading instruction in mother tongue for students whose mother tongue is not &lt;language of test&gt;?.</td>
<td>ACBGTONG</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-15A</td>
<td>Does your school have a library?</td>
<td>ACBGLI</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-15B</td>
<td>Approximately how many books with different titles does your school library have (exclude magazines and periodicals)?</td>
<td>ACBGLIBC</td>
<td>500 or fewer</td>
<td>More than 500</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-15B</td>
<td>Approximately how many titles of magazines and other periodicals does your school library have?</td>
<td>ACBGLIBM</td>
<td>10 or fewer</td>
<td>More than 10</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-16</td>
<td>What is the total number of computers that can be used for instructional purposes by &lt;fourth-grade&gt; students?</td>
<td>ACBGCMP1</td>
<td>15 or less</td>
<td>More than 15</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-17A</td>
<td>Does your school provide teachers with a workspace in the classroom?</td>
<td>ACBGFAC1</td>
<td>Yes</td>
<td>No</td>
</tr>
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<td>SCHOOL</td>
<td>CG1-17B</td>
<td>Does your school provide teachers with a workspace shared by several teachers?</td>
<td>ACBGFAC2</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-17C</td>
<td>Does your school provide teachers with a separate workspace for each teacher (e.g., office)?</td>
<td>ACBGFAC3</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-18A</td>
<td>How much is your school’s capacity to provide instruction affected by a shortage or inadequacy of instructional staff?</td>
<td>ACBGSI1</td>
<td>Some or a lot</td>
<td>A little or not at all</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-18B</td>
<td>How much is your school’s capacity to provide instruction affected by a shortage or inadequacy of teachers with a specialization in reading?</td>
<td>ACBGSI2</td>
<td>Some or a lot</td>
<td>A little or not at all</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-18C</td>
<td>How much is your school’s capacity to provide instruction affected by a shortage or inadequacy of second language teachers?</td>
<td>ACBGSI3</td>
<td>Some or a lot</td>
<td>A little or not at all</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-18D</td>
<td>How much is your school’s capacity to provide instruction affected by a shortage or inadequacy of instructional materials (e.g., textbooks)?</td>
<td>ACBGSI4</td>
<td>Some or a lot</td>
<td>A little or not at all</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-18E</td>
<td>How much is your school’s capacity to provide instruction affected by a shortage or inadequacy of supplies (e.g., papers, pencils)?</td>
<td>ACBGSI5</td>
<td>Some or a lot</td>
<td>A little or not at all</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-18F</td>
<td>How much is your school’s capacity to provide instruction affected by a shortage or inadequacy of school buildings and grounds?</td>
<td>ACBGSI6</td>
<td>Some or a lot</td>
<td>A little or not at all</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-18G</td>
<td>How much is your school’s capacity to provide instruction affected by a shortage or inadequacy of heating/cooling and lighting systems?</td>
<td>ACBGSI7</td>
<td>Some or a lot</td>
<td>A little or not at all</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-18H</td>
<td>How much is your school’s capacity to provide instruction affected by a shortage or inadequacy of instructional space (e.g., classrooms)?</td>
<td>ACBGSI8</td>
<td>Some or a lot</td>
<td>A little or not at all</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-18I</td>
<td>How much is your school’s capacity to provide instruction affected by a shortage or inadequacy of special equipment for physically disabled students?</td>
<td>ACBGSI9</td>
<td>Some or a lot</td>
<td>A little or not at all</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-18J</td>
<td>How much is your school’s capacity to provide instruction affected by a shortage or inadequacy of computers for instructional purposes?</td>
<td>ACBGSI10</td>
<td>Some or a lot</td>
<td>A little or not at all</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-18K</td>
<td>How much is your school’s capacity to provide instruction affected by a shortage or inadequacy of computer software for instructional purposes?</td>
<td>ACBGSI11</td>
<td>Some or a lot</td>
<td>A little or not at all</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-18L</td>
<td>How much is your school’s capacity to provide instruction affected by a shortage or inadequacy of computer support staff?</td>
<td>ACBGSI12</td>
<td>Some or a lot</td>
<td>A little or not at all</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-18M</td>
<td>How much is your school’s capacity to provide instruction affected by a shortage or inadequacy of library books?</td>
<td>ACBGSI13</td>
<td>Some or a lot</td>
<td>A little or not at all</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-18N</td>
<td>How much is your school’s capacity to provide instruction affected by a shortage or inadequacy of audio-visual resources?</td>
<td>ACBGSI14</td>
<td>Some or a lot</td>
<td>A little or not at all</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-19A</td>
<td>Are adult literacy programs for &lt;language of test&gt; speakers available at your school site for the children and families in your school?</td>
<td>ACBGRP51</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-19B</td>
<td>Are adult literacy programs for non&lt;language of test&gt; speakers available at your school site for the children and families in your school?</td>
<td>ACBGRP52</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-19C</td>
<td>Are parent education programs (e.g., classes on child development, education on being a parent) available at your school site for the children and families in your school?</td>
<td>ACBGRP53</td>
<td>Yes</td>
<td>No</td>
</tr>
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<tr>
<td>SCHOOL</td>
<td>CG1-19D</td>
<td>Are health or social services available at your school site for the children and families in your school?</td>
<td>ACBGPRS4</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-20A</td>
<td>How often are teacher-parent conferences provided by your school for &lt;fourth-grade&gt; students and/or their families?</td>
<td>ACBGPRO1</td>
<td>Once a year or less</td>
<td>More than once a year</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-20B</td>
<td>How often are letters, calendars, newsletters, etc. sent home by your school for &lt;fourth-grade&gt; students and/or their families?</td>
<td>ACBGPRO2</td>
<td>Once a year or less</td>
<td>More than once a year</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-20C</td>
<td>How often are written reports (report cards or portfolios) of child’s performance sent home by your school for &lt;fourth-grade&gt; students and/or their families?</td>
<td>ACBGPRO3</td>
<td>Once a year or less</td>
<td>More than once a year</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-20D</td>
<td>How often are events at school to which parents are invited provided by your school for &lt;fourth-grade&gt; students and/or their families?</td>
<td>ACBGPRO4</td>
<td>Once a year or less</td>
<td>More than once a year</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-21A</td>
<td>Approximately what percentage of students in your school have parents or guardians who volunteer regularly to help in the classroom or another part of the school?</td>
<td>ACBGPAR1</td>
<td>10% or less (or n/a)</td>
<td>More than 10%</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-21B</td>
<td>Approximately what percentage of students in your school have parents or guardians who attend teacher-parent conferences?</td>
<td>ACBGPAR2</td>
<td>25% or less (or n/a)</td>
<td>More than 25%</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-21C</td>
<td>Approximately what percentage of students in your school have parents or guardians who attend cultural, sporting, or social events at the school?</td>
<td>ACBGPAR3</td>
<td>25% or less (or n/a)</td>
<td>More than 25%</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-22A</td>
<td>How would you characterize teacher job satisfaction within your school?</td>
<td>ACBGCHA1</td>
<td>Medium to very low</td>
<td>High to very high</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-22B</td>
<td>How would you characterize teachers’ expectations for student achievement within your school?</td>
<td>ACBGCHA2</td>
<td>Medium to very low</td>
<td>High to very high</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-22C</td>
<td>How would you characterize parental support for student achievement within your school?</td>
<td>ACBGCHA3</td>
<td>Medium to very low</td>
<td>High to very high</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-22D</td>
<td>How would you characterize students’ regard for school property within your school?</td>
<td>ACBGCHA4</td>
<td>Medium to very low</td>
<td>High to very high</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-22E</td>
<td>How would you characterize students’ desire to do well in school within your school?</td>
<td>ACBGCHA5</td>
<td>Medium to very low</td>
<td>High to very high</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-22F</td>
<td>How would you characterize students’ regard for each other’s welfare?</td>
<td>ACBGCHA6</td>
<td>Medium to very low</td>
<td>High to very high</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-23A</td>
<td>To what degree is student tardiness a problem in your school?</td>
<td>ACBGPB1</td>
<td>Moderate or serious</td>
<td>Minor or not at all</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-23B</td>
<td>To what degree is student absenteeism a problem in your school?</td>
<td>ACBGPB2</td>
<td>Moderate or serious</td>
<td>Minor or not at all</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-23C</td>
<td>To what degree is classroom disturbance a problem in your school?</td>
<td>ACBGPB3</td>
<td>Moderate or serious</td>
<td>Minor or not at all</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-23D</td>
<td>To what degree is cheating a problem in your school?</td>
<td>ACBGPB4</td>
<td>Moderate or serious</td>
<td>Minor or not at all</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-23E</td>
<td>To what degree is proficiency a problem in your school?</td>
<td>ACBGPB5</td>
<td>Moderate or serious</td>
<td>Minor or not at all</td>
</tr>
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<td>SCHOOL</td>
<td>CG1-23F</td>
<td>To what degree is vandalism a problem in your school?</td>
<td>ACBGPB6</td>
<td>Moderate or serious</td>
<td>Minor or not at all</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-23G</td>
<td>To what degree is theft a problem in your school?</td>
<td>ACBGPB7</td>
<td>Moderate or serious</td>
<td>Minor or not at all</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-23H</td>
<td>To what degree is intimidation or verbal abuse among students a problem in your school?</td>
<td>ACBGPB8</td>
<td>Moderate or serious</td>
<td>Minor or not at all</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-23I</td>
<td>To what degree are physical conflicts among students a problem in your school?</td>
<td>ACBGPB9</td>
<td>Moderate or serious</td>
<td>Minor or not at all</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-23J</td>
<td>To what degree is drug abuse a problem in your school?</td>
<td>ACBGPB10</td>
<td>At least a minor problem</td>
<td>Not a problem at all</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-23K</td>
<td>To what degree are weapons a problem in your school?</td>
<td>ACBGPB11</td>
<td>At least a minor problem</td>
<td>Not a problem at all</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-23L</td>
<td>To what degree is racism a problem in your school?</td>
<td>ACBGPB12</td>
<td>At least a minor problem</td>
<td>Not a problem at all</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-24</td>
<td>Does your school have an official policy related to promoting cooperation and collaboration among teachers?</td>
<td>ACBGCOOP</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>CG1-25</td>
<td>About how often do the teachers in your school have formally scheduled time to meet to share or develop instructional materials and approaches?</td>
<td>ACBGDEV</td>
<td>Less than once a month</td>
<td>At least once a month</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-01</td>
<td>Are you a boy or a girl?</td>
<td>ASBGSEX</td>
<td>Boy</td>
<td>Girl</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-03A</td>
<td>How often do you read aloud to someone at home?</td>
<td>ASBGTOC1</td>
<td>At least once a week</td>
<td>Less than once a week</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-03B</td>
<td>How often do you listen to someone at home read aloud to you?</td>
<td>ASBGTOC2</td>
<td>At least once a week</td>
<td>Less than once a week</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-06A</td>
<td>In school, how often does your teacher read aloud to the class?</td>
<td>ASBGTHC1</td>
<td>At least once a week</td>
<td>Less than once a week</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-06B</td>
<td>In school, how often do you read aloud to the whole class?</td>
<td>ASBGTHC2</td>
<td>At least once a week</td>
<td>Less than once a week</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-06C</td>
<td>In school, how often do you read aloud to a small group of students in your class?</td>
<td>ASBGTHC3</td>
<td>At least once a week</td>
<td>Less than once a week</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-06D</td>
<td>In school, how often do you read silently on your own?</td>
<td>ASBGTHC4</td>
<td>At least once a week</td>
<td>Less than once a week</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-06E</td>
<td>In school, how often do you read books you choose yourself?</td>
<td>ASBGTHC5</td>
<td>At least once a week</td>
<td>Less than once a week</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-11B</td>
<td>How often do you use a computer at school?</td>
<td>ASBGUPC2</td>
<td>At least once a week</td>
<td>Less than once a week</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-17A</td>
<td>During the last month at school was something stolen from you?</td>
<td>ASBGSTL</td>
<td>Yes</td>
<td>No</td>
</tr>
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<tr>
<td>STUDENT</td>
<td>SG1-17B</td>
<td>During the last month at school was something stolen from someone in your class?</td>
<td>ASBGOSTL</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-17C</td>
<td>During the last month at school were you bullied by another student?</td>
<td>ASBGSBUL</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-17D</td>
<td>During the last month at school was someone in your class bullied by another student?</td>
<td>ASBGOBUL</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-17E</td>
<td>During the last month at school were you injured by another student?</td>
<td>ASBGSHRT</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-17F</td>
<td>During the last month at school was someone in your class injured by another student?</td>
<td>ASBGOHRT</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-18A</td>
<td>Did you speak &lt;language of test&gt; before you started school?</td>
<td>ASBGLNG1</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-19</td>
<td>How often do you speak &lt;language of test&gt; at home?</td>
<td>ASBGLNGH</td>
<td>Not always</td>
<td>Always</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-20</td>
<td>About how many books are there in your home?</td>
<td>ASBGBOOK</td>
<td>25 or fewer</td>
<td>More than 25</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-21A</td>
<td>Do you have a computer at home?</td>
<td>ASBGT A1</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-21B</td>
<td>Do you have a study desk/table for your use at home?</td>
<td>ASBGT A2</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-21C</td>
<td>Do you have books of your very own (not school books) at home?</td>
<td>ASBGT A3</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-21D</td>
<td>Do you have a daily newspaper at home?</td>
<td>ASBGT A4</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-21E</td>
<td>Do you have your own room at home?</td>
<td>ASBGT A5</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-21F</td>
<td>Do you have your own mobile (cellular) phone at home?</td>
<td>ASBGT A6</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-21G</td>
<td>Do you have &lt;country-specific indicator of wealth&gt; at home?</td>
<td>ASBGT A7</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-21H</td>
<td>Do you have &lt;country-specific indicator of wealth&gt; at home?</td>
<td>ASBGT A8</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-21I</td>
<td>Do you have &lt;country-specific indicator of wealth&gt; at home?</td>
<td>ASBGT A9</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>STUDENT</td>
<td>SG1-21J</td>
<td>Do you have &lt;country-specific indicator of wealth&gt; at home?</td>
<td>ASBGT A10</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-01A</td>
<td>How many students are in this class?</td>
<td>ATBGCSTD</td>
<td>More than 20</td>
<td>20 or fewer</td>
</tr>
<tr>
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<tr>
<td>TEACHER</td>
<td>TG1-04</td>
<td>How many students experience difficulties understanding spoken language of test?</td>
<td>ATBGOIFU</td>
<td>More than 25% of students</td>
<td>25% or less of students</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-05A</td>
<td>How many students need remedial instruction in reading?</td>
<td>ATBGNIDIN</td>
<td>More than 25% of students</td>
<td>25% or less of students</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-05B</td>
<td>How many students who need it receive remedial instruction in reading?</td>
<td>ATBGRCIN</td>
<td>More than 50% of students</td>
<td>50% or less of students</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-06A</td>
<td>Is there any provision for enrichment reading instruction in your school?</td>
<td>ATBGERCN</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-06B</td>
<td>How many students receive enrichment reading instruction because they are advanced readers?</td>
<td>ATBGERCN</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-08A1</td>
<td>In a typical week, how much time do you spend on language of test language instruction and/or activities? (hours)</td>
<td>ATBGACTH</td>
<td>5 hours or less</td>
<td>More than 5 hours</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-08B1</td>
<td>In a typical week, how much time do you spend on reading instruction and/or activities? (hours)</td>
<td>ATBGRINH</td>
<td>2 hours or less</td>
<td>More than 2 hours</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-08C</td>
<td>Is any of the reading instruction time for formal reading instruction?</td>
<td>ATBGFINR</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-09</td>
<td>How often do you have reading instruction and/or do reading activities?</td>
<td>ATBGRACT</td>
<td>3 days a week or less</td>
<td>Every day</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-15A</td>
<td>When you have reading instruction and/or do reading activities with the students, how often do you read aloud to the whole class?</td>
<td>ATBGRRA1</td>
<td>Every day</td>
<td>Once or twice a week or less</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-15B</td>
<td>When you have reading instruction and/or do reading activities with the students, how often do you ask students to read aloud to the whole class?</td>
<td>ATBGRRA2</td>
<td>Every day</td>
<td>Once or twice a week or less</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-15C</td>
<td>When you have reading instruction and/or do reading activities with the students, how often do you ask students to read aloud in small groups or pairs?</td>
<td>ATBGRRA3</td>
<td>Every day</td>
<td>Once or twice a week or less</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-15D</td>
<td>When you have reading instruction and/or do reading activities with the students, how often do you ask students to read silently on their own?</td>
<td>ATBGRRA4</td>
<td>Every day</td>
<td>Once or twice a week or less</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-15E</td>
<td>When you have reading instruction and/or do reading activities with the students, how often do you ask students to read along silently while other students read aloud?</td>
<td>ATBGRRA5</td>
<td>Every day</td>
<td>Once or twice a week or less</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-15F</td>
<td>When you have reading instruction and/or do reading activities with the students, how often do you give students time to read books of their own choosing?</td>
<td>ATBGRRA6</td>
<td>Every day</td>
<td>Once or twice a week or less</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-15G</td>
<td>When you have reading instruction and/or do reading activities with the students, how often do you teach or model for students different reading strategies?</td>
<td>ATBGRRA7</td>
<td>Every day</td>
<td>Once or twice a week or less</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-15H</td>
<td>When you have reading instruction and/or do reading activities with the students, how often do you teach students strategies for decoding sounds and words?</td>
<td>ATBGRRA8</td>
<td>Every day</td>
<td>Once or twice a week or less</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-15I</td>
<td>When you have reading instruction and/or do reading activities with the students, how often do you teach students new vocabulary systematically?</td>
<td>ATBGRRA9</td>
<td>Every day</td>
<td>Once or twice a week or less</td>
</tr>
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<tr>
<td>TEACHER</td>
<td>TG1-15J</td>
<td>When you have reading instruction and/or do reading activities with the students, how often do you help students understand new vocabulary in texts they are reading?</td>
<td>ATBGRA10</td>
<td>Every day</td>
<td>Once or twice a week or less</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-16A</td>
<td>After students have read something, how often do you ask them to answer in a workbook or worksheet reading comprehension questions about what they have read?</td>
<td>ATBGAFT1</td>
<td>Every day</td>
<td>Once or twice a week or less</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-16B</td>
<td>After students have read something, how often do you ask them to write something about or in response to what they have read?</td>
<td>ATBGAFT2</td>
<td>At least once a week</td>
<td>Twice a month or less</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-16C</td>
<td>After students have read something, how often do you ask them to answer oral questions about or orally summarize what they have read?</td>
<td>ATBGAFT3</td>
<td>At least once a week</td>
<td>Twice a month or less</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-16D</td>
<td>After students have read something, how often do you ask them to talk with each other about what they have read?</td>
<td>ATBGAFT4</td>
<td>At least once a week</td>
<td>Twice a month or less</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-16E</td>
<td>After students have read something, how often do you ask them to do a project about what they have read (e.g., a play or art project)?</td>
<td>ATBGAFT5</td>
<td>At least once a month</td>
<td>Never or almost never</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-16F</td>
<td>After students have read something, how often do you ask them to take a written quiz or test about what they have read?</td>
<td>ATBGAFT6</td>
<td>At least once a month</td>
<td>Never or almost never</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-17A</td>
<td>How often do you ask students to identify the main ideas of what they have read to help develop reading comprehension skills or strategies?</td>
<td>ATBGDEV1</td>
<td>Twice a month or less</td>
<td>At least once a week</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-17B</td>
<td>How often do you ask students to explain or support their understanding of what they have read to help develop reading comprehension skills or strategies?</td>
<td>ATBGDEV2</td>
<td>Twice a month or less</td>
<td>At least once a week</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-17C</td>
<td>How often do you ask students to compare what they have read with experiences that they have had to help develop reading comprehension skills or strategies?</td>
<td>ATBGDEV3</td>
<td>Twice a month or less</td>
<td>At least once a week</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-17D</td>
<td>How often do you ask students to compare what they have read with other things they have read to help develop reading comprehension skills or strategies?</td>
<td>ATBGDEV4</td>
<td>Twice a month or less</td>
<td>At least once a week</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-17E</td>
<td>How often do you ask students to make predictions about what will happen next in the text to help develop reading comprehension skills or strategies?</td>
<td>ATBGDEV5</td>
<td>Twice a month or less</td>
<td>At least once a week</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-17F</td>
<td>How often do you ask students to make generalizations and draw inferences based on what they have read to help develop reading comprehension skills or strategies?</td>
<td>ATBGDEV6</td>
<td>Twice a month or less</td>
<td>At least once a week</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-17G</td>
<td>How often do you ask students to describe the style or structure of the text they have read to help develop reading comprehension skills or strategies?</td>
<td>ATBGDEV7</td>
<td>Twice a month or less</td>
<td>At least once a week</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-18</td>
<td>Are computers available for use by your class?</td>
<td>ATBGPCA1</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-18AA</td>
<td>Are one or more computers available in your classroom?</td>
<td>ATBGCA1</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-18AB</td>
<td>Are computers available elsewhere in the school?</td>
<td>ATBGCA2</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-18B</td>
<td>Do any of the computers have access to the Internet (email of World Wide Web)?</td>
<td>ATBGWWW</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-18CA</td>
<td>How often do you have students use computers to look up information on the internet?</td>
<td>ATBGAPC1</td>
<td>At least once a month</td>
<td>Never or almost never</td>
</tr>
<tr>
<td>PIRLS 2006 Questionnaire</td>
<td>PIRLS 2006 Question Location</td>
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<tr>
<td>TEACHER</td>
<td>TG1-18CC</td>
<td>How often do you have students to read stories or other texts on the computer?</td>
<td>ATBGAFC3</td>
<td>At least once a month</td>
<td>Never or almost never</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-18CD</td>
<td>How often do you have students to use instructional software to develop reading skills or strategies?</td>
<td>ATBGAFC4</td>
<td>At least once a month</td>
<td>Never or almost never</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-18CE</td>
<td>How often do you have students use computers to write stories or other texts?</td>
<td>ATBGAFC5</td>
<td>At least once a month</td>
<td>Never or almost never</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-19</td>
<td>Do you have a library or reading corner in your classroom?</td>
<td>ATBGLICR</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-19A1</td>
<td>About how many books with different titles are in your classroom library?</td>
<td>ATBGLIBK</td>
<td>30 books or less</td>
<td>More than 30 books</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-19A2</td>
<td>About how many magazines with different titles are in your classroom library?</td>
<td>ATBGLIMG</td>
<td>2 magazine titles or less</td>
<td>More than 2 magazine titles</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-19B</td>
<td>How often do you give the students in your class time to use the classroom library or reading corner?</td>
<td>ATBGULUS</td>
<td>Twice a month or less</td>
<td>At least once a week</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-19C</td>
<td>Can the students borrow books from the classroom library or reading corner to take home?</td>
<td>ATBGLIBW</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-19C</td>
<td>Can the students borrow books from the classroom library or reading corner to take home?</td>
<td>ATBGLIBW</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-20</td>
<td>How often do you take or send the students to a library other than your classroom library?</td>
<td>ATBGULSL</td>
<td>Twice a month or less</td>
<td>At least once a week</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-23A</td>
<td>Is a &lt;reading specialist&gt; available to work in your classroom with those students who have difficulty with reading?</td>
<td>ATBGUDF1</td>
<td>Never</td>
<td>Sometimes or Always</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-23B</td>
<td>Is a &lt;reading specialist&gt; available to work in a &lt;remedial reading classroom&gt; with those students who have difficulty with reading?</td>
<td>ATBGUDF2</td>
<td>Never</td>
<td>Sometimes or Always</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-23C</td>
<td>Is a teacher-aide or other adult available to work in your classroom with those students who have difficulty with reading?</td>
<td>ATBGUDF3</td>
<td>Never</td>
<td>Sometimes or Always</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-23D</td>
<td>Are other professionals available to work in your classroom with those students who have difficulty with reading?</td>
<td>ATBGUDF4</td>
<td>Never</td>
<td>Sometimes or Always</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-24A</td>
<td>If a student begins to fall behind in reading, do you wait to see if performance improves with maturation?</td>
<td>ATBGUHR1</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-24B</td>
<td>If a student begins to fall behind in reading, do you spend more time working on reading individually with that student?</td>
<td>ATBGUHR2</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-24C</td>
<td>If a student begins to fall behind in reading, do you have other students work in the regular classroom on reading with the student having difficulty?</td>
<td>ATBGUHR3</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-24D</td>
<td>If a student begins to fall behind in reading, do you have the student work in the regular classroom with a teacher-aide?</td>
<td>ATBGUHR4</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-24E</td>
<td>If a student begins to fall behind in reading, do you have the student work in the regular classroom with a &lt;reading specialist&gt;?</td>
<td>ATBGUHR5</td>
<td>Yes</td>
<td>No</td>
</tr>
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</tr>
<tr>
<td>TEACHER</td>
<td>TG1-24F</td>
<td>If a student begins to fall behind in reading, do you have the student work in a &lt;remedial reading classroom&gt;? with a &lt;reading specialist&gt;?</td>
<td>ATBGHR6</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-24G</td>
<td>If a student begins to fall behind in reading, do you assign homework to help the student catch up?</td>
<td>ATBGHR7</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-24H</td>
<td>If a student begins to fall behind in reading, do you ask the parents to help the student with reading?</td>
<td>ATBGHR8</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-26A</td>
<td>For the typical &lt;fourth-grade&gt; student in this class, how often do you meet or talk individually with the child's parents to discuss his/her progress in reading?</td>
<td>ATBGPCO1</td>
<td>Less than 4 times a year</td>
<td>At least 4 times a year</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-28A</td>
<td>For the typical &lt;fourth-grade&gt; student in this class, how often do you send a progress report on the child's reading home to his/her parents?</td>
<td>ATBGPCO2</td>
<td>Less than 4 times a year</td>
<td>At least 4 times a year</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-29</td>
<td>By the end of this school year, how many years will you have been teaching altogether?</td>
<td>ATBGTAUG</td>
<td>10 years or less</td>
<td>More than 10 years</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-30</td>
<td>By the end of this school year, how many years will you have been teaching &lt;fourth-grade&gt;?</td>
<td>ATBGTAU</td>
<td>2 years or less</td>
<td>More than 2 years</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-31</td>
<td>How old are you?</td>
<td>ATBGAGE</td>
<td>Under 30</td>
<td>30 or older</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-32</td>
<td>Are you male or female?</td>
<td>ATBGSEX</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-33</td>
<td>What is the highest level of formal education you have completed?</td>
<td>ATBGLHE</td>
<td>ISCED 3 or lower</td>
<td>ISCED 4 or higher</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-35A</td>
<td>As part of your formal education and/or training, to what extent did you study &lt;language of test&gt; language?</td>
<td>ATBGEAR1</td>
<td>Overview or introduction at most</td>
<td>Area of emphasis</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-35B</td>
<td>As part of your formal education and/or training, to what extent did you study literature?</td>
<td>ATBGEAR2</td>
<td>Overview or introduction at most</td>
<td>Area of emphasis</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-35C</td>
<td>As part of your formal education and/or training, to what extent did you study pedagogy/teaching reading?</td>
<td>ATBGEAR3</td>
<td>Overview or introduction at most</td>
<td>Area of emphasis</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-35D</td>
<td>As part of your formal education and/or training, to what extent did you study psychology?</td>
<td>ATBGEAR4</td>
<td>Overview or introduction at most</td>
<td>Area of emphasis</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-35E</td>
<td>As part of your formal education and/or training, to what extent did you study remedial reading?</td>
<td>ATBGEAR5</td>
<td>Overview or introduction at most</td>
<td>Area of emphasis</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-35F</td>
<td>As part of your formal education and/or training, to what extent did you study reading theory?</td>
<td>ATBGEAR6</td>
<td>Overview or introduction at most</td>
<td>Area of emphasis</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-35G</td>
<td>As part of your formal education and/or training, to what extent did you study children's language development?</td>
<td>ATBGEAR7</td>
<td>Overview or introduction at most</td>
<td>Area of emphasis</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-35H</td>
<td>As part of your formal education and/or training, to what extent did you study special education?</td>
<td>ATBGEAR8</td>
<td>Overview or introduction at most</td>
<td>Area of emphasis</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-35I</td>
<td>As part of your formal education and/or training, to what extent did you study second language learning?</td>
<td>ATBGEAR9</td>
<td>Overview or introduction at most</td>
<td>Area of emphasis</td>
</tr>
<tr>
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<tr>
<td>TEACHER</td>
<td>TG1-36</td>
<td>In the past two years, how many hours in total have you spent in in-service/professional development workshops or seminars that dealt directly with reading or teaching reading?</td>
<td>ATBGSEMI</td>
<td>None</td>
<td>At least one hour</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-37A</td>
<td>For your professional development, about how often do you read books or professional journals related to teaching in general?</td>
<td>ATBGRDPP1</td>
<td>Twice a month or less</td>
<td>At least once a week</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-37B</td>
<td>For your professional development, about how often do you read books or professional journals related to teaching reading?</td>
<td>ATBGRDPP2</td>
<td>Twice a month or less</td>
<td>At least once a week</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-37C</td>
<td>For your professional development, about how often do you read children's books?</td>
<td>ATBGRDPP3</td>
<td>Twice a month or less</td>
<td>At least once a week</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-38</td>
<td>When you are at home, how often do you read for enjoyment?</td>
<td>ATBGRDJY</td>
<td>Twice a month or less</td>
<td>At least once a week</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-41A</td>
<td>How much do you agree with the statement, &quot;I am content with my profession as a teacher&quot;?</td>
<td>ATBGSAT1</td>
<td>Disagree</td>
<td>Agree</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-41B</td>
<td>How much do you agree with the statement, &quot;I am satisfied with being a teacher at this school&quot;?</td>
<td>ATBGSAT2</td>
<td>Disagree</td>
<td>Agree</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-41C</td>
<td>How much do you agree with the statement, &quot;I would describe the teachers at this school as a satisfied group&quot;?</td>
<td>ATBGSAT3</td>
<td>Disagree</td>
<td>Agree</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-41D</td>
<td>How much do you agree with the statement, &quot;I had more enthusiasm when I began teaching than I have now&quot;?</td>
<td>ATBGSAT4</td>
<td>Agree</td>
<td>Disagree</td>
</tr>
<tr>
<td>TEACHER</td>
<td>TG1-41E</td>
<td>How much do you agree with the statement, &quot;I do important work as a teacher&quot;?</td>
<td>ATBGSAT5</td>
<td>Disagree</td>
<td>Agree</td>
</tr>
<tr>
<td>HOME</td>
<td>Derived</td>
<td>Parents on Child's Early Literacy Skills</td>
<td>ASDHAIB</td>
<td>Not very well or worse</td>
<td>Moderately well or better</td>
</tr>
<tr>
<td>HOME</td>
<td>Derived</td>
<td>Parents' Highest Education Level</td>
<td>ASDHEDUP</td>
<td>Less than upper-secondary</td>
<td>Upper-secondary or higher</td>
</tr>
<tr>
<td>HOME</td>
<td>Derived</td>
<td>Index Early Home Literacy Activts (EHLA)</td>
<td>ASDHEHLA</td>
<td>Medium or Low</td>
<td>High</td>
</tr>
<tr>
<td>HOME</td>
<td>Derived</td>
<td>Parents' Highest Occupation Level</td>
<td>ASDHOCCP</td>
<td>Not professional</td>
<td>Professional</td>
</tr>
<tr>
<td>HOME</td>
<td>Derived</td>
<td>Index Parents' Att Toward Reading (PATR)</td>
<td>ASDHPATR</td>
<td>Medium or Low</td>
<td>High</td>
</tr>
<tr>
<td>HOME</td>
<td>Derived</td>
<td>Parents' Employment Situations</td>
<td>ASDHPEMP</td>
<td>Both full time</td>
<td>At least one less than full time</td>
</tr>
<tr>
<td>HOME</td>
<td>Derived</td>
<td>Parents' Employment Situations</td>
<td>ASDHPEMP</td>
<td>At least one less than full time</td>
<td>Both full time</td>
</tr>
<tr>
<td>HOME</td>
<td>Derived</td>
<td>Parents' Prcptn of Schl Environment (PPSE)</td>
<td>ASDHPPSE</td>
<td>Medium or Low</td>
<td>High</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>Derived</td>
<td>Index Availibility of Schl Resources (ASR)</td>
<td>ACDGASR</td>
<td>Medium or Low</td>
<td>High</td>
</tr>
<tr>
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</tr>
<tr>
<td>SCHOOL</td>
<td>Derived</td>
<td>Availability of Computers for Instruction</td>
<td>ACDGCMP</td>
<td>More than 20 students</td>
<td>20 students or less</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>Derived</td>
<td>Index of Home-School Involvement (HSI)</td>
<td>ACDGHSI</td>
<td>Medium or Low</td>
<td>High</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>Derived</td>
<td>Index Prncpl’s Prctn School Clnt (PPSC)</td>
<td>ACDGPPSC</td>
<td>Medium or Low</td>
<td>High</td>
</tr>
<tr>
<td>SCHOOL</td>
<td>Derived</td>
<td>Index Prncpl’s Prctn School Sfty (PPSS)</td>
<td>ACDGPPSS</td>
<td>Medium or Low</td>
<td>High</td>
</tr>
<tr>
<td>STUDENT</td>
<td>Derived</td>
<td>Index Home Educational Resources (HER)</td>
<td>ASDHHER</td>
<td>Medium or Low</td>
<td>High</td>
</tr>
<tr>
<td>STUDENT</td>
<td>Derived</td>
<td>Index of Student Safety in Schools (SIS)</td>
<td>ASDGSSS</td>
<td>Medium or Low</td>
<td>High</td>
</tr>
<tr>
<td>STUDENT</td>
<td>Derived</td>
<td>Stds Rprts On Stds Readng Aloud in Class</td>
<td>ASDGTHC</td>
<td>At least once a week</td>
<td>Less than once a week</td>
</tr>
<tr>
<td>STUDENT</td>
<td>Derived</td>
<td>Stds Rprts On Stds Readng Aloud in Class</td>
<td>ASDGTHC</td>
<td>Less than once a week</td>
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<tr>
<td>TEACHER</td>
<td>Derived</td>
<td>No Access to Any Specialist</td>
<td>ATDGDF2</td>
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<td>Index of Reading for Homework (RFH)</td>
<td>ATDGRFH</td>
<td>Medium or Low</td>
<td>High</td>
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<td>Use of Fiction for Reading Instruction</td>
<td>ATDGRTXF</td>
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<td>Less than weekly</td>
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