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ABSTRACT

The poor state of quality education in South Africa is confirmed by the weak performance of South African students on international tests, even when compared to countries with comparatively poorer education systems. This paper aims to shed light on this issue through the use of the PIRLS 2006 dataset and education production function techniques. A unique feature of this dataset is that schools were able to choose the language in which the test was conducted. This provided a proxy for former school department, a feature that has not been captured in international survey datasets. A clear distinction between the historically black and the historically white, coloured and Indian school systems is needed in order to identify the different data generating processes at work. The regression model results reveal that family and student characteristics are undoubtedly important for performance within both school samples. At the level of the school, quite divergent school factors and classroom processes were found to have significant impacts on student performance across the two school systems. It is concluded that a lack of enabling conditions such as effective leadership, flexibility and autonomy, and a capable teaching force may contribute to certain school and classroom processes not playing a significant role in determining performance in the less affluent black school system.

Keywords: South Africa, Education, Education production function, Educational Achievement, Educational Inequality
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1. Introduction

Despite concerted efforts to equalise the distribution of school resources in the South African education system, a large portion of the system still fails to provide the quality of education needed for sustained economic growth. The poor state of quality education in South Africa is confirmed by the weak performance of South African students on international tests, even when compared to countries with comparatively poorer education systems. Results from the 2003 TIMSS[2]tests at grade 8 indicate that of the fifty countries that took part, South Africa came last. It can therefore be argued that South African schooling is neither effective nor particularly efficient. Although the link between race and performance is strong, black children from better socio-economic backgrounds perform exceedingly better than their less-affluent counterparts. However, with higher socio economic status comes improved choice, and hence these students are largely observed to be in affluent schools. Research indicates that the problem lies in the dismal performance of the historically black school system that has failed to improve educational outcomes among the poor (Van der Berg, Wood & Roux, 2002: 305). The bimodal pattern of results that is typically observed illustrates how far historically black schools continue to lag behind White, Indian and Coloured schools in performance, and hints toward the vast difference in the quality of schooling that is provided for a minority of the school-going population. A further telling feature of the inequality that exists in the South African education system is the high intraclass correlation coefficient (rho)[3] that is observed almost consistently in test score data, especially in literacy and reading scores. This measure – which expresses the variance in performance between schools as a proportion of the overall variance in tests scores – has been found to be as high as 0.70 for SACMEQ[4] 2000 reading scores (Van der Berg, 2006: 5). Therefore, a better understanding of the factors that hamper performance in the poorer, mainly black, school system is needed.

This paper aims to shed light on this issue through the use of education production function techniques. The PIRLS[5] 2006 dataset, which provides a wealth of information on student and family background, as well as at the level of the teacher and the school, is utilised for this purpose. A unique feature of this dataset is that schools were able to choose the language in which the test was conducted. This made it possible to identify, albeit crudely, the former department of each school, by identifying those schools that tested in English and Afrikaans separate from those that tested in an African language. Given the potential overlap between the two school groups (as it is probable that former black and homeland schools may have chosen to test in English or Afrikaans), further

[2]Trends in International Mathematics and Science Study
[3](Koch, 1982)
[4]Southern and Eastern Africa Consortium for Monitoring Educational Quality
[5]Progress in International Reading Literacy Study

restrictions were made to the group of English and Afrikaans testing schools. These restrictions will be discussed later. The reasoning behind separating the two groups of schools is the notion that quite different school production processes may be operating in affluent schools than in poorer schools. Therefore, distinguishing the two groups of schools will serve to identify the different data generating processes that may exist, and provide some indication of those factors that inhibit the performance of former black and homeland schools, and contribute to better performance in affluent schools. To this end, the reading test scores of each school group will be regressed on socio-economic status (at the individual and school level), pupil and family background characteristics, school and teacher inputs, as well as school and classroom processes.

The paper proceeds as follows: first, a summary of the established school effectiveness literature, followed by a summary of effectiveness studies compiled in the South African context. This is followed by a discussion of the methodology (as well as its limitations) and data employed. Section 5 presents descriptive statistics and empirical results. Section 6 concludes.

2. Brief Overview of the Established Literature on School Effectiveness

A vast literature exists on the measurement of the determinants of educational achievement that collectively fall under the effective schools research literature.[6] The first, and arguably the most important, of these studies is the "Equality of Educational Opportunity" Report, which has since come to be known as the "Coleman Report".[7] The data collected by the report –covering more than 500 000 primary and secondary students from more than 3000 schools in the United States –provided information on student background and characteristics, school achievement and detailed descriptions of the sampled schools. The main purpose of the Coleman Report was to identify those educational inputs that were most important in determining the educational achievement of students, particularly with regard to the performance of students from socially disadvantaged and minority backgrounds. The expectation was that divergent school funding and spending across racial lines were the main predictors of the observed performance gap between black and white students. However, the findings proved to be controversial. The Coleman Report concluded that differences at the school level had little impact on school performance, and that family background and student characteristics were the most influential factors in educational outcomes. Of all the school inputs considered, the provision of high quality teachers was found to have the greatest impact. Furthermore, the effect of the socio-economic background of school peers proved to be far more important than school funding.

[6]The extent of this work can be illustrated by the works contained within the journal *School Effectiveness and School Improvement* and books such as *The International Handbook of School Effectiveness Research* (2000).

[7]Coleman et al, 1966

A significant body of quantitative research has emerged since the Coleman Report that, in part, hoped to show that schools do in fact matter for educational performance. In an early summary of 90 education production function studies conducted in the United States since the Coleman Report, Hanushek (1986) found little consistency in the results. He concluded that little evidence is given of a significant or consistent relationship between school spending and student performance.[8] These findings have subsequently led to the global discussion on "does money matter?" an issue which has not yet been settled given the many methodological issues surrounding the estimation of education production functions, particularly omitted variable bias. However, despite the controversial nature of the report's main findings, they have been difficult to disprove. Subsequent quantitative analysis has found only limited empirical support for the importance of school factors for educational achievement (Van der Berg and Louw, 2007: 5). However, this is not to say that schools do not matter at all, but rather that "schools cannot compensate for society" (Bernstein, 1971).

Findings in studies of education production in developing countries have offered slightly different results. In their analysis of sub-Saharan African primary schools, Craig and Heneveld (1996) note that, in terms of school effectiveness, school quality appears to matter more for student performance in developing countries than in developed ones. This is not to say that the social context of the school and its student body are less important, as the "cultural and social norms [what we loosely term "context"] influence the schools' functioning even more than in the industrial countries…" (Craig and Heneveld, 1996: 18). Although on aggregate schools are estimated to have little impact on student performance, this is not to say that different groups of students may in fact gain from the presence of specific school inputs and overall functioning. It was noted in the concluding remarks of the Coleman Report that improvements in school quality would have the largest impact for the achievement of the most disadvantaged children (Hanushek, 1996: 22). A further noteworthy finding of the Coleman Report is the impact of intrinsic control on student achievement. It is argued that students from less affluent backgrounds are far less confident of affecting their own environments and futures. However, when such intrinsic control over their performance is present, these students manage to achievebetter schooling outcomes than affluent students who lack such confidence (Ginsburg & Bronstein, 1993). There is reason to believe that the school (or perhaps the social context of the school) may play a role in developing such behavior. Therefore, it has become necessary for the question of what works for schools to be reformulated as what works for those less affluent schools and students who have performed beyond what was expected. Consequently, emphasis has been shifted from identifying the school inputs that result in better performance (that is, school effectiveness), to identifying the particular features of effective schools.

[8]This is the case even when disaggregating school spending across its components or considering spending at the aggregate level (Webbink, 2005: 536).

The characteristics of effective schools identified vary considerably from study to study. However, a number of regularly recurrent characteristics have been identified. Using information from various studies on school effectiveness, Purkey & Smith (1983) described the core elements of an effective school as broadly falling under two categories of variables: organisational/structural and process. The former comprises of, inter alia, staff stability, parental involvement and support, maximised learning time, and instructional leadership. Similarly, the process variables are described as including a strong sense of community, clear goals and high expectations, order and discipline, and collaborative planning (Cohn & Rossmiller: 1987). However, as Skipper (2006) notes, without a proper organisational structure in place, the scopefor developing the necessary processes are limited.

More recent effectiveness studies have employed more sophisticated data analysis techniques in the hope of correcting for the methodological issuesthat plague school production estimation (Creemers, 1996). These studies often employ multi-level statistical techniques (such as hierarchical linear modeling), which are combined with information rich datasets that often include observations at the school and classroom levels. Consequently, a broad consensus seems to have developed around a number of factors that have significant impact on school outcomes, which include: strong leadership, learning ethos and environment, positive reinforcement, close monitoring of student progress, and purposeful teaching (see, for example, Reynolds et al (1997), Mortimore (1998) and Levine & Lezotte (1990)). Based upon a review of the school effectiveness literature, the following framework of school effectiveness (depicted in Figure 1 of the Appendix) has been offered by Heneveld & Craig (1996). The framework consists of an interconnected network of 16 factors that influence student outcomes that have been further categorised into four groups: supporting inputs; enabling conditions; school climate; and teaching/learning process. The contextual factors within which schools operate (economic, political, social) are also accounted for. It has been established that one of the uses of this framework is as an "evaluation tool to analyse individual primary schools in Africa in order to formulate more general pictures of school quality in a given education system" (Yu, 2007: 11). It is for this purpose that the framework is utilised in this study.

3. School effectiveness in the South African context

3.1 Determinants of Educational Outcomes

A number of studies have sought to examine the role played by both schools and family in determining educational outcomes in South Africa. Specifically, researchers have sought to understand the role that historically inequitable distribution of school resources has played increating the large discrepancies in educational attainment and performance across different parts of the education system.This is important as some of these discrepancies, particularly in performance and quality, are still evident today, despite a consolidated education system and considerable shifts in

resources to black schools since democratization. Until recent years, studies tended to focus on the period 1993 to 2000, mostly as a result of the limited access to adequate survey data. However, the recent availability of a number of international survey datasets has provided new opportunities for investigating the relationship between educational outcomes and student and school characteristics.

Employing pre-democratisation datasets, Case and Deaton (1999) find that after controlling for family background, pupil-teacher ratios (commonly used as a proxy for school quality) have a positive and significant impact on educational attainment and test scores. These effects are, however, confined to African students. Van der Berg and Burger (2003) draw divergent conclusions to Case and Deaton in their study of school performance in the Western Cape. They find that resource allocation variables largely fail to explain the poor performance of black and coloured students, and conclude that efforts to improve teacher quantity and quality are unlikely to translate into improvements in schooling outcomes. Rather, it can be argued that a focus needs to be placed on improving teaching materials and teaching aids as well as, and possibly more importantly, improving the efficiency of the education system through targeted managerial interventions. The divergent results observed pre- and post-apartheid may be due to the concerted effort by the Department of Education to bring the pupil-teacher ratios of historically black schools in line with those of historically white schools. Despite substantial declines in pupil-teacher ratios in historically black schools, historically white schools maintain an advantage.[9]

Pupil-teacher ratios and other conventional measures of school quality may not be correct measures for explaining the impact of school-related factors in education production functions (Van der Berg and Louw, 2007: 6). As the Coleman Report and other studies have concluded, there is insubstantial evidence of a strong relationship between educational performance and access to higher levels of spending and school resources. As was put forward earlier in this paper, student performance may result from the fact that some schools are more effective in transforming educational inputs into educational outputs than other schools. The impact of smaller classroom sizes and lower pupil-teacher ratios may appear insignificant in the education production functions not because school quality does not matter for educational achievement, but rather because the impact of school quality works through other mechanisms which are either directly or indirectly related to classroom size and pupil-teacher ratios. Van der Berg and Louw (2007) list a number of reasons as to why smaller class sizes may be correlated with higher performance other than that it may lead to better quality education. For

[9] School governing bodies (subsidized by parents) are a prominent feature of historically white schools. They are able to increase spending on providing school resources such as higher quality teaching staff (Van der Berg and Louw, 2007: 6), which can contribute to lower pupil-teacher ratios amongst this group of schools. A further contribution to divergent pupil-teacher ratios across ex-school departments is the lower growth of teaching staff in historically black schools in response to increasing numbers of students (Yamauchi, 2005), due in part to the disinclination of teachers to move to rural schools who suffer higher class sizes than urban counterparts.

example, the more able the child or the more affluent the household background, the higher the likelihood that parents may ensure that their children are placed in smaller classes or insist that higher levels of funding take place in their child's school.

Anderson et al. (2001) employ data from the 1995 October Household Survey (OHS) to investigate the relationship between parental characteristics and children's schooling attainment. They find a strong positive relationship between a mother's education and that of her child/ren. Using the 1993 South African Living Standards Survey (SALSS), Case and Deaton (1999) find similar effects. However, the underlying process driving this relationship is unknown. Parental education may enter the education production function directly as children with well-educated parents are more likely to obtain human capital through their home environment (Lam, 1999). Better-educated parents may also choose to reside in areas with access to good schools. Family structure also plays a role in determining educational outcomes. South Africa is characterised by a diversity of family living arrangements. Using the 1995 OHS, Anderson (2000) finds family structure to be highly correlated with the educational outcomes of blacks aged 10 to 24. The best educational performance is found in children who reside with both their biological parents.

Despite the narrowing educational attainment gap and large increases in the resources transferred to historically disadvantaged schools, inequalities in South Africa's education system persist. There is evidence of a bimodal distribution of student performance, indicating a different data generating process for historically white schools than for historically black schools (Van der Berg, 2008). Schools differ greatly in their ability to convert educational inputs into educational outcomes, as revealed by survey regression and hierarchical linear model analysis on the SACMEQ II survey data. Socio-economic differences continue to have an important impact on educational outcomes, with students attending poor schools being even more disadvantaged in their ability to perform well in tests. These findings are reiterated by Taylor and Yu (2009) in their analysis of the influence of socio-economic status on educational achievement in South Africa. Employing data from the second round of the Progress in International Reading Literacy Study (PIRLS) that was executed in 2005/6, they find that student background (as proxied by socio-economic status) explains a sizeable amount of the variation in reading test scores between grade 5 students. Furthermore, they find the average socio-economic status of a school to be a more important determinant of educational outcomes than the socio-economic status of an individual student. This is not to say that the socio-economic status of a child is irrelevant in determining educational success. It may be the major factor contributing to the choice of school a child has access to (Taylor and Yu, 2008: 48). These findings appear to corroborate the findings of Coleman et al (1966) – the distribution of students of divergent socio-economic backgrounds across schools plays a vital role in educational outcomes. Referring back to the effectiveness framework of Craig and Heneveld (see figure 1 of the appendix), much of the functioning and processes that are relevant to school performance and quality are directly linked to the

social and cultural context of the school. Research has further illustrated that the factors contributing to school effectiveness may differ between high- and low-SES effective schools. Hallinger & Murphy (1986), for example, find that low-SES effective schools are more likely to maximize the amount of time allocated to basic skills instruction during school time, and make less use of homework. Teaching processes such as these may compensate for the lack of school preparedness of students, as well as a lack of time available for independent study outside of school. Schools with different social contexts may therefore emphasise quite different tasks to promote effective instruction. Parent involvement is further observed to be higher in high- versus low-SES schools, whereas low-SES schools rely more heavily on providing students with tangible (extrinsic) rewards for their classroom accomplishments in order to instill more motivation and confidence. This is in contrast to students who respond to intrinsic motivation; that is, given a proper foundation of readiness, a potential for higher levels of skill development, and a positive orientation toward learning, classroom tasks are "interesting and rewarding in and of themselves" (Hallinger & Murphy, 1986: 345). Students in high-SES schools tend more to display these traits, likely due to a home background which encourages a higher valuation of schooling and a positive orientation towards learning.

The link between socio economic status and schooling outcomes in South Africa is discussed in more detail in the following section.

3.2 Understanding the Social Context of South African schools

Despite a distinct movement toward racial integration in historically white, coloured and Indian schools, socio-economic integration has not occurred at the same level (Taylor and Yu, 2008: 49). One might argue that the movement of students has occurred in a fairly predictable way. Following democratization, there has been a "flight" of more affluent black students out of historically black schools, with little if any movement in the opposite direction (Soudien, 2004: 104).[10] Black schools are consequently left with the poorest members of the community (Soudien, 2004: 106). This may have impacts on the educational performance of historically black schools, as the disadvantages faced by those from less affluent backgrounds are perpetuated through peer effects and low quality education.

Socio-economic class has replaced race as the major determining factor of the social character or culture of a school. Although schools are meant to admit any child if a place exists, there are many mechanisms in place that prevent poor children from attending affluent schools. Legislation provides

[10] An example of this is provided in an article by Woolman and Fleisch (2006). They describe how Sandown High in Sandton, Gauteng, is oversubscribed whereas on the other side of town in Orlando High, Soweto, classrooms stand empty. Many of the students attending Sandown High reside close to Soweto, yet they choose to travel many kilometers to attend school elsewhere.

additional facilitation of the class alignment within schools through policy such as the South African Schools Act (SASA). The Act requires the institution of school governing bodies (SGBs) in all schools that are to be comprised of parents, teachers, students and administrative staff (Soudien, 2004: 108). Many of the schools' SGBs charge fees to cover the costs of schooling not borne by the state. This power to charge fees creates an incentive to admit as many full fee-paying students as the school can accommodate (Woolman & Fleisch, 2006: 32). SASA further allows SGBs to assume power over the most important managerial decisions. However, the institution of SGBs may have done little to increase the involvement of black parents in these decision-making processes, as middle-class white parents continue to dominate the SGBs of formerly white schools. Black parents from less affluent backgrounds find it difficult to meet the time and resource requirements demanded of an SGB member. Consequently, SGBs in historically black schools continue to be run by the principal and teachers.

Schools play a key role in both the formation and continuation of social patterns (including inequality), and it is maintained by many that schooling can be used as a tool for achieving social equity. However, it is important to note that some of the rules and norms on which schooling is based may automatically advantage some pupils more than others (Christie et al, 2007: 22). This issue is especially relevant in post-apartheid South Africa where the achievement of access, quality and equity in schooling is a central goal. Inequalities in the South African education system are evident in patterns of educational achievement across income groups. One such trend is discerned by van der Berg (2007) using the Senior Certificate pass rate results of 2003. He finds that close to one in 10 of white students attending public schools achieved a matric A-aggregate, whereas just more than one in 1000 black students achieved similar results. Furthermore, half of the black matriculants that passed with an A-aggregate were observed to have attended formerly white or Indian schools. It should be noted that in 2003, close to 94 percent of all black grade 12 students attended predominantly black schools.

4. Data and empirical methodology

4.1 Empirical model: Education production function

Any comparison of student performance in different education systems requires previous knowledge of the education process whereby education outcomes are produced. The standard approach to determining factors improving education outcomes is the production function approach. This method is widely applied in the education economics literature, and is conventionally used to investigate the determinants of education outcomes, as well as to draw conclusions as to which determinants matter more for education outcomes.

The general conceptual education production model describes the achievement of a given student at a particular point in time as a cumulative process; that is to say, past inputs are argued to have a lasting effect on current school performance, although diminishingly so as time passes. This may be represented as:

$$A_{it} = f(B_i^{(t)}, P_i^{(t)}, S_i^{(t)}, T_i^{(t)}, I_i$$

where A_{it} is student i's achievement at time t, $B_i^{(t)}$ is a vector of family background factors cumulative to time t, $P_i^{(t)}$ is a vector of peer influences cumulative to time t, $S_i^{(t)}$ is a vector of school inputs cumulative to time t, $T_i^{(t)}$ is a vector of teacher inputs cumulative to time t, and I_i is a vector of student innate ability. This form of education production necessitates somewhat strong assumptions about the dynamics of education, as well as measures of initial endowments. The specification of inputs has also received much criticism, with the choice of inputs seemingly directed more by the available data and not by what is conceptually desirable (Hanushek, 1979: 363). Particularly, information regarding prior inputs, most notably ability, tends to be unknown or immeasurable.

An alternative, less data intensive, version of the model is the "value-added" model. This model supposes observing only two points in time, say t and t*, represented as:

$$A_{it} = f^*(B_i^{(t-t*)}, P_i^{(t-t*)}, S_i^{(t-t*)}, T_i^{(t-t*)}, I_i, A_{it*})$$

Therefore, current educational performance is modelled as a function of family, peer, school and teacher inputs observed at a prior time t* and current time t, as well as prior achievement A_{it*}. The value-added approach manages to partly overcome two problems that persist in education production modelling. These are omitted variable bias, particularly with regards to innate abilities, and the poor measurement and/or capturing of prior inputs into education. The latter problem is probably the more insidious of the two regarding bias estimates. However, both are potentially important, so they merit some discussion.

The lack of adequate measures of inherent ability[11] has proven to be a persistent problem when attempting to estimate conceptual models of educational attainment. In reality, not all school, family and individual student characteristics that are important in determining schooling outcomes will be observed. Furthermore, is it likely that theory has not identified all variables that should be controlled

[11]It is furthermore difficult to determine precisely what should be captured by this term or how it should be defined (Hanushek, 1979: 364).

for in estimating education production functions. Educational production functions are frequently interpreted as if the included regressors are both theoretically supported and accurately measured (Hanushek, 1979: 366). This may not be the case. Through not allowing for unobserved factors, the estimated effects of observed factors on educational outcomes will be biased (Webbink, 2005: 538). The size of the bias will be related to both the influence of the variable on achievement and the correlation of the omitted variable with other regressors in the model (Hanushek, 1979: 365). The innate ability of a student may be closely related to other factors that are controlled for in the model, such as family background. Through omitting innate ability in the model, the estimated impact of family background on educational performance will be biased upwards, assuming that innate ability is positively correlated with family background factors such as household income.Through including prior achievement as a control variable in the model, any "level" effects of innate ability have been included, and only "growth" effects will have been omitted (Hanushek, 1986: 1156). With regards to past family, peer and school inputs, overcoming the lack of historical family background information is less awkward, as measurement error is likely to be small given that these inputs tend to be fairly constant over time. Measurement errors tend to be most severe in the case of school inputs. As students experience different teachers and school inputs at different points in their schooling, contemporaneous measures of inputs are far les accurate indicators of past inputs. Peer inputs are also likely to change over time, especially with student migration between schools. As a result of these measurement errors, the impact of school inputs on schooling outcomes will be underestimated.

In reality, most data available for education production estimation are cross-sectional in nature. This is the case for this study. As a result, only current achievement and schooling inputs are available, providing the following model to be estimated:

$$A_{it} = f(B_i, P_i, S_i, T_i, I_i)$$

Given the nature of the final model which is somewhat simplified from the conceptual model, it is vital that the caveats outlined above are well understood. Ignoring these issues could lead to potentially misleading conclusions. Consequently, the estimation power of the production function approach employed by this study is limited in that the estimated model coefficients may only be regarded as causal effects under certain (and quite implicit) assumptions, and the magnitudes are not necessarily indicative of their true impact on education performance.

4.2 Further methodological issues

One issue that needs to be addressed concerns the possibility that their may be sorting between schools. Certain schools attract students with higher ability parents seeking high quality education for their children. For example, student sorting may result if parents choose to reside in areas where good schools are easily accessible. If this is the case, differences in student body composition would not be wholly exogenous in that the presence of students in certain schools would be partly determined by school quality. As a result, regression estimates would overstate the extent to which educational performance depends on student characteristics. The Heckman (1979) two-step correction procedure provides a tool for correcting for possible sample selection bias in regression estimates. This involves running an auxiliary probit model of school choice from which the inverse mill's ratio (selection variable) can be calculated and included as a regressor in the education production function. If the coefficient on the selection variable is insignificant, this would suggest that school sorting is not an issue for the model in question. Correcting for selection bias can be problematic. An identification problem can arise if variables which are important for modelling school choice also appear as independent variables in the final regression models. Variables that determine school choice but are not important for educational performance are required in order to avoid this. Unfortunately, adequate survey data that offer an array of potential covariates are difficult to come by, especially in the developing country context. For this reason, issues of school sorting were ignored for purposes of this study. This will have impacts for the regression coefficients and their interpretation.

Multicollinearity is a further problem ever-present in the estimation of education production functions (Bowles & Levin, 1968). Multicollinearity occurs when two regressors in a regression function are closely correlated to one another. Therefore, if some school level variables are directly related to family background variables, the impact of the school on educational performance may be underestimated. Disentangling the separate effects of regressors which are highly inter-correlated can be very difficult. However, this does not reduce the predictive power or reliability of the model, but leads to biased estimates on individual predictors. In fact, Hanushek (1979) argues that the importance of multicollinearity in educational production functions may be overrated. For more detailed discussions of these and other problems, see Hanushek (1979), Webbink (2005) and Behrman (1996).

4.3 Data

The PIRLS survey conducted in 2005/6 by the International Association for the Evaluation of Educational Achievement (IEA) formed the data source for this paper. PIRLS 2006 is the second of these studies conducted in a five year cycle (after PIRLS 2001) in which particular emphasis is placed

on the reading proficiency of young children. Testing of students in their fourth year of schooling was carried out in 40 countries, including Belgium with two education systems and Canada with 5 provinces (PIRLS International Report, 2006: 16), thus a total of 45 education systems. However, students tested in Luxembourg, New Zealand and South Africa were sampled from the fifth grade. In addition to the collection of reading scores of students, a full array of background information regarding home and school environments was collated. It was hoped that the contextual questionnaires would provide information about how students' achievement are related to aspects of curricula, instruction, and school environment, and how these relationships differed between countries.

In South Africa, 14125 grade 5 students were sampled from 385 schools. The large size of the dataset makes PIRLS 2006 highly advantageous for analysing educational outcomes and their determinants in South Africa. Given the large intraclass correlation coefficient observed in performance data in South Africa, the sample of schools needs to be suitably large such that sufficient variation in schooling outcomes can be obtained. Of all the countries that participated in the PIRLS 2006 survey, the situation in South Africa proved to be the most complex, given that the questionnaires and assessment tools had to be translated into all of the 11 different languages. This situational complexity was cited as the main reason for testing fifth grade rather than fourth grade students in South Africa. However, data on the language of testing allowed the schools to be differentiated between those that fall under the former black education system and the rest.

The dependent variable employed in the empirical model is the individual student reading score calculated using average scale scores computed from 5 plausible imputed scores based on Item Response Theory (IRT). The international scores were set on a scale with an average of 500 and a standard deviation of 100.[12] A general to specific modelling procedure was followed. This implies that variables found to significantly model the outcome were retained, although certain control variables supported by theory were retained regardless of statistical significance. In addition to household SES and parent education, the following pupil and family background variables (mostly dummy variables) were included: whether the student is under- or over-age, student's gender, frequent reading homework, time spent on reading homework, reading activities at home (daily reading by child, parent, as well as index of early reading activities), whether the child and child's mother spoke the test language at home, more than 10 books at home, feeling of safety at school, and employment status of parents (both fulltime employed, or at least one parent fulltime employed).In addition to average SES of the school, the following school inputs where included: urban/suburban location of the school, no

[12]See Taylor (2008: 7) for a more detailed summary of the testing process followed.

students receiving free/reduced cost lunch, severity of pupil absenteeism, parent involvement,[13] the majority of the school took part in extended instruction time, and a time index of principal's management activities. At the classroom/teacher level, the following factors were controlled for: large class size (more than 30 students), teacher has a degree, frequency of various classroom activities (including worksheets, group discussing, oral feedback, and questions answered aloud by students, students' own choice of reading book, and homework) as reported by pupils and teacher, instructional tools (reading series, long books with chapters, diagnostic tests), teacher satisfaction, teacher collaboration, and various teacher demographic variables such as age, gender and experience.

As this study is interested in the different production processes that may predominate at poor versus affluent schools, the sample of students had to be divided into two school groups. No information of the former school department was offered by the dataset. However, information concerning the language of testing was provided. It is safe to assume that schools that tested in an African language would have fallen under the historically black system. It is furthermore likely that schools formerly belonging to the relatively more affluent white, Indian and coloured education departments would have tested in English or Afrikaans. This resulted in a sample of 259 schools that tested in an African language, and 126 schools that tested in English or Afrikaans. However, an overlap between the two groups may exist in that a number of formerly black schools may have tested in (particularly) English, yet instruction continued to be given in an African language.[14] Given the existence of schools where testing occurred in English, yet the bulk of the student body were less likely to speak the language of testing on either a first or second language basis, a restriction was applied to the sample of African language testing schools. If more than 65 percent of the grade 5 sample from a particular school was found to not speak the test language on a regular basis, this school was dropped from the analysis. Additionally, if the proportion of students that lacked access to basic utilities (water, electricity and heating) exceeded 30 percent,[15] the school was dropped from the English and Afrikaans testing sample. This decision to drop schools and not simply move them to the African language testing sample was made as it could not be guaranteed that all the schools meeting the aforementioned exclusion restrictions do in fact belong to the group of former black schools. In fact, some of the excluded schools may be historically white, Indian or coloured schools, albeit poor and poor

[13]The measure of parent involvement takes into account both the opportunities created by the school for parents to be involved (supply side), and the willingness by parents to be involved (demand side). The variable is coded as follows: 1 if the school has more than 2 formal parent conferences per year, and more than 25 percent of parents attend; 0 otherwise.

[14] In a separate study by Desai (2001), a primary school in Khayelitsha, Cape Town was observed where the home language of the majority of learners and educators was Xhosa. However, since 1995 the school has decided to use English as the medium of in which all school work is to be expressed from grade 4. However, this did not prevent the teachers from relaying information to the students in Xhosa.

[15] This is the average proportion for the group of historically black schools.

performing ones. Consequently, the remaining sample of English and Afrikaans testing schools may suffer from sample selection bias, leading to upward bias in the estimates. This should be kept in mind when interpreting the results. Applying these restrictions, the group of English and Afrikaans testing schools was reduced from 126 to 70 schools. This appears to be similar to what is observed in the South African education system: 21 percent formerly white, coloured and Indian schools and 79 percent formerly black schools.

In the process of choosing covariates to be regressed on the student reading score, two new variables had to be generated. These were a wealth measure of a pupil's household represented by a socio-economic index, and the average wealth measure of the school student body. There is much support for using asset-based indices to represent wealth or income, and they perform well in education production functions (see for example Filmer & Pritchett, 2001). Both of these indices were generated using the principal components analysis (PCA) technique developed by Pearson (1901). Through mathematical procedures, PCA is able to transform a large number of correlated variables into a smaller number of uncorrelated variables called principal components. For purposes of this study, only the first principal component was used as a measure of SES. The measure of pupil SES was further standardised to have a mean of 0 and a standard deviation of 1. The average socio-economic status of the students in a school was used to provide a measure of the average wealth of a school. This measure was similarly standardised to have a mean of 0 and a standard deviation of 1.

The main problem posed by the data was that of a large number of missing data, particularly at the student level. Commonly, missing values on one or more of the explanatory variables would imply that the whole observation (the student) be excluded from the sample. Therefore, the more regressors included in the eventual model, the smaller the sample size is likely to become given missing responses on some questions. Performing the analysis only for students with no missing data may lead to sample selection bias, as weaker students are more likely to leave blank answers. Dropping these students would reduce the amount of variation in the dependent variable, causing an upward bias in the results (Ammermuller, 2006: 4). Missing data on household possession items was overcome by recoding missing values as "not possessed". Missing values on parent education were imputed using the modal parental education by school. Missing values on categorical variables at the student level were included separately in the model as a separate category. In most cases, the coefficients on these variables were not found to be significantly different from the reference category. Consequently, missing data on categorical variables were grouped with the reference category. The problem of missing data at the school level was a bit more difficult to resolve. However, given the comparatively smaller number of missing data at this level, schools with missing data were dropped from the

sample.[16] As a result, the final sample size included 9139 students in 240 African language testing schools, and 2107 students in 66 English and Afrikaans testing schools.

Given the nested nature of the data, all econometric modelling techniques used need to take this into account. The main assumption regarding clustered data is that observations within clusters will not be independent (Van der Berg & Louw, 2006: 3). To deal with this, the survey design is taken into account in estimating the empirical models. The stratum variable is province[17] and the primary sampling unit variable is the school. Parameter estimates are calculated to be robust to heteroskedasticity.

5. Empirical results

5.1 Summary Statistics

Table A1 of the appendix presents weighted summary statistics of the variables included in the model by type of school. The average reading scores are 251.5 and 464.6 for African language testing schools and the English/Afrikaans testing schools respectively, representing a raw performance gap of 213.1 that is statistically significant at the 5 percent level. On average, South African students attending both school types performed lower than the international average, with African language testings schools performing close to two and a half standard deviations (on the international scale) below this average. A higher standard deviation of test scores for English/Afrikaans testing schools (125.2) indicates that the spread of test scores around the mean is greater for these schools than for the African language testing schools (83.6). This fact is graphically depicted in Figure 1. The distribution of reading scores for the group of African language testings schools is clearly found to lie to the left of the English/Afrikaans testing schools' distribution. Furthermore, the distribution of the former is more concentrated around the mean, whereas a larger variance of test scores exists for English/Afrikaans testing schools. [18]

16 Dealing with missing data at the teacher level proved more challenging, especially with regards to the sample of English/Afrikaans testing schools. Dropping teachers with missing data from the regression analysis resulted in significant changes in the coefficients on teacher covariates, indicating that teachers with missing data arenot a random subsample. This was not the case with African language testing schools. Therefore, the issue wasaddressed in a similar manner as missing data at the student/household level i.e. including a dummy variable coded as 1 if missing data, and 0 otherwise.

[17]Although there are 9 provinces in South Africa, only 1 English/Afrikaans testing school was identified in the Northern Cape. Resultantly, 8 stratum were used through combining the data from the Western Cape with the data of the Northern Cape.

[18] Figure 2 of the Appendix shows the distribution of test scores between the two school types before further restrictions were applied to the English/Afrikaans testing schools. The plateau-like shape of the English/Afrikaans testing school distribution points towards what was noted in the data section of this paper; that is, an overlap between the two school types. It is clear that the distribution of test scores for the excluded schools more closely resembles the distribution of test

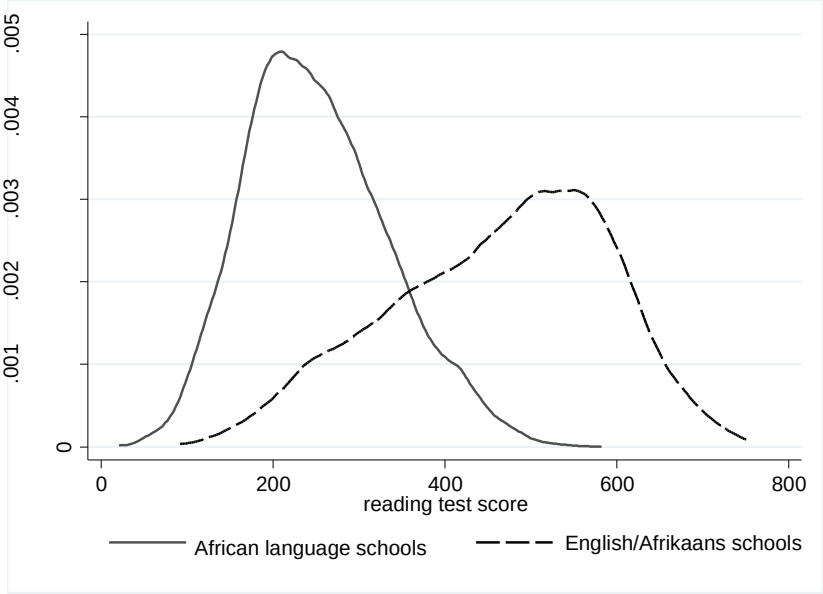
The summary statistics (see table 1 of the Appendix) of the respective covariates used in the empirical model clearly illustrate the differences in the composition of the student body in the two school types. Covariates were controlled for at four levels: the student level, the household level, the classroom/teacher level and the school level. Additional controls for province were also included. English/Afrikaans testing schools have significantly lower proportions of overage and underage students (17 percent overage and 5percent underage compared to 54 and 7 percent in African language testing schools). Similar proportions of female students and students that speak the test language all the time at home are found in both school types. However, only a further 15 percent of students attending African language testing schools speak the language of the test sometimes at home, compared to 33 percent of English/Afrikaans testing schools' students. Interestingly, there is no significant difference in the proportion of students at each school type who spend more than 5 hours per day on the computer, or watch more than 5 hours of television per day. The proportion of students that spend more than an hour on their reading homework is not significantly different at either school type. 40 percent of students attending English/Afrikaans testing schools further report to receive homework at least three times a week, compared to 35percent of students at African language testing schools. This difference is significant at the 90 percent level. A further significant difference is the different proportions of students receiving help with their reading homework from their parents. This proportion is 32 percent in English/Afrikaans testing schools, compared to 17 percent in African language testing schools. A significantly larger proportion of students at English/Afrikaans testing schools borrow library books in the test language, and read magazines on a daily basis. Summary statistics on family background variables indicate that the average SES of students attending English/Afrikaans testing schools is above the sample average (0.78), whereas the average SES of students attending African language testing schools is lower than the sample average (-0.27). The sample of English/Afrikaans testing schools further contains a significantly higher percentage of students with better educated parents, parents who both have fulltime employment, mothers who speak the test language all the time at home, parents who read more than 10 hours a week, and households with more than 10 books.

The data further reveal that the two school types differ in their processes and average level of resources. More than half of the African language testing schools have either a severe or moderate student absenteeism problem (34percent severe and 19 percent moderate). This is compared to English/Afrikaans testing schools with only 17 percent of schools experiencing a severe absenteeism problem, and 12 percent experiencing a moderate absenteeism problem. African language testing

scores for the African language testings schools. Therefore, there appears to be some evidential support for excluding these schools from the group of English/Afrikaans testing schools.

schools are significantly poorer on average than English/Afrikaans testing schools as measured by the average SES of the student body (-0.47 compared to 1.34). Significantly higher ratios of English/Afrikaans testing schools are located in either urban or suburban areas, have greater parent involvement, do not provide free or reduced lunch programmes to their student body, and have a large proportion of the student body involved in extended instruction time. There does not appear to be a significant difference in the index of time spent by the principal on management activities.

Figure 1: Kernel density distributions of reading scores, by school type



Source: own calculations, PIRLS 2006

At the classroom and teacher levels, a significantly higher proportion of grade 5 classes are larger than 30 in African language testing schools. A higher proportion of teachers with degrees are also observed in these schools (26 percent compared to 24percent in English/Afrikaans testing schools), yet a significantly larger proportion of teachers with teaching diplomas are found in the latter (68 percent in English/Afrikaans testing schools compared to 50 percent in African language testing schools).Therefore, whereas more than 90 percent of teachers in English/Afrikaans testing schools have some form of post-matric qualification, the same is true of only 76 percent of teachers in African language testing schools.

There is no significant difference in the frequent use of worksheet exercises after reading as reported by students, although twice the proportion of students in African language testing schools than in English/Afrikaans testing schools report frequently answering questions aloud in class after reading. In terms of teacher reporting of class exercises, teachers in African language testing schools report

almost daily use of worksheets in class, discussion amongst the students following reading, and oral feedback from students, as well as more frequent assignment of reading homework. This may illustrate a difference in the type of class exercises or methods of assessment that are employed across the two schools, or perhaps that a variety of techniques are employed daily in reading classes in African language testing schools, whereas exercises may vary from day to day in English/Afrikaans testing schools. The data also reveals that significantly higher proportions of students in English/Afrikaans testing schools are able to choose books of their own choice to read in class, significantly higher proportions of reading classes in these schools are exposed to reading series and longer books with chapters as part of their reading instruction, as well as significantly less diagnostic testing. With regards to teacher demographics, African language testing schools have significantly higher proportions of male teachers, teachers younger than 40, and teachers with fewer than 16 years of teaching experience. Furthermore, a significantly higher proportion of teachers in English/Afrikaans testing schools report high levels of teacher collaboration.

Observing the distribution of schools across provinces, the highest concentration of African language testing schools are found in the Eastern Cape (24 percent), KwaZulu Natal (22 percent), and Limpopo (17 percent). The highest concentrations of English/Afrikaans testing schools are found in the Western/Northern Cape (43 percent), Gauteng (22 percent) and KwaZulu Natal (16 percent).

The data therefore reveal that students attending English/Afrikaans testing schools possess higher average endowments of individual and family background characteristics that have been shown to be related to higher school performance. Furthermore, these schools themselves have higher endowments of school resources and school processes known to lead to more effective school production (refer to section 2). Results of the multivariate regression analysis follow.

5.2 Multivariate Regression Analysis

This section explores the impact of various pupil, family background, school, teacher, and classroom inputs on student reading performance. Four versions of the empirical model were run for each of the school samples; that is, English/Afrikaans testing school and African language testing schools. Specification [1] models the reading test score as a function of only the pupil and family background variables, specification [2] extends this to include provincial dummies, whilst specification [3] further includes school levelinputs. Specification [4] further includes teacher and classroom level inputs. The results of all fourspecifications for each school sampleare presented in table 2 of the appendix,

although focus will be placed on the coefficient estimates from specification 4 (final model). The final model fits the sample of English/Afrikaans schools quite well, as observed by an adjusted R-squared of 0.72. The adjusted R-squared is slightly lower in the sample of African language testing schools (0.34), partly explained by the lack of variation in the outcome variable. It is interesting to note that the adjusted R-squared for specification 1 – before the addition of school, classroom and teacher variables - is already quite large at 0.52 and 0.21 for the English/Afrikaans and African language samples respectively.[19]

Pupil and family background characteristics are in most cases observed to have similar impacts on reading performance, although the size of the impact may differ between the two samples. The size and significance of the student level variables remain fairly robust after controlling for school, teacher and classroom covariates, although slight reductions are observed. This illustrates positive correlation with school level variables and a degree of multicollinearity between family and school level variables. Variables whose impact decreases once controlling for school level factors include parent education, parent employment, household SES and number of books at home. The choice of school may therefore be correlated with these household level variables; that is, children from more affluent households and better educated parents are more likely to attend better performing schools. Conversely, the coefficients on variables such as underage, overage, and time spent watching television or playing on the computer increase in size after controlling for school and classroom covariates. This indicates a negative correlation between these sets of variables. To explain, once we control for those factors that are common to classroom peers, the negative impact of being overage and spending large amounts of time watching television, for example, are amplified as the impact of these factors are determined both relative to students of similar family and demographic backgrounds, as well as relative to students found in the same classroom. Therefore, an overage child in a class of very few overage children is likely to be performing far below the average of his/her peers than would be the case for an overage child in a class with a high proportion of overage children.

All coefficients are interpreted as the impact of a marginal change in the covariate on expected student performance, controlling for all other schooling inputs. The effect of being overage is observed to have a negative and significant impact on reading test scores, although the effect is stronger in English/Afrikaans testing schools (a decrease in expected test score of 18 pointsversus a decrease of

[19] Following the addition of province controls in [2], the R-squared for the African language testing sample increases to 0.28, while it only increases by a further percentage point after the inclusion of school controls. In the case of the English/Afrikaans testing schools, the addition of province controls increases the R-squared to 0.58, whereas additional school controls substantially increases the R-squared to 0.69. This may indicate variation in performance across provinces for African language testing schools, which may be linked to differences in provincial school functioning. In the case of English/Afrikaans testing schools, there appears to be within province variation in performance, and hence school functioning.

36 points). The impact of being underage is only statistically significant in African language testing schools, leading to a decrease in expected test score of 21 points. The estimated effect of being female is positive and significant in both regressions, with the strongest effect observed in African language testing schools (26points). Likewise, frequent use of the test language at home leads to a positive and significant impact on the test score. In English/Afrikaans testing schools this leads to an advantage of between 24 and 29 points, compared to an 11 point advantage in African language testing schools. Watching more than 5 hours of television or playing more than 5 hours of computer games per day negatively and significantly influences the reading test score. Frequent reading homework has a positive and significant impact on reading test scores in African language testing schools (18 points); frequent reading homework has an insignificant impact on students' scores in English/Afrikaans schools. There is therefore a reward to students from African language testing schools for exerting effort in their school work. [20]The same is true of parent assistance with homework and borrowing books in the test language, although the significant impact observed in African language testing schools is quite small (6and 8 points increase in expected reading score for parent help and borrowing books respectively). Interestingly, the impactof time spent on homework that is observed between the two school samples is quite divergent. Spending more than an hour on reading homework results in an 8 point increase (statistically significant) for students in the African language school sample, compared to an 11 point decrease (statistically significant) for students in English/Afrikaans school sample. Therefore, studentsattending an African language testing school and spending more than an hour on their reading homework, perform better on average than students who spend less than an hour on their homework, all else constant.Conversely, a student attending an English/Afrikaans school that spends more than an hour on their reading homework performs on average worse, all else constant. This may illustrate a difference in the role of homework in the two school sub-systems.

Homework may function as an extension to learning time (educational purpose), or may be related to teacher perceptions of parent interest and involvement (symbolic purpose) (Hallinger & Murphy, 1986: 340). High SES schools may view homework as serving both these purposes, whereas low SES schools may focus more on the former. Teachers from high- versus low-SES schools may also differ in their expectations of students with regards to the completion and understanding of homework. Data from the PIRLS 2006 teacher questionnaire reveals that teachers from English/Afrikaans testing schools are more likely to give homework that is expected to take less than 30 minutes to complete. This may illustrate the use of homework as more a means of reinforcing parent expectations. However, frequent reading homework as reported by the teacher is estimated tohave apositive impact, increasing expected reading scores by 28 points in English/Afrikaans schools, *ceteris paribus*. No

[20]Given that homework is work done outside of formal school instruction hours, it is thought to be a suitably direct measure of student effort.

significant impact is observed in African language testing schools. This indicates that homework adds to student performance in affluent schools, hence fulfilling its educational purpose, whereas no such benefit is observed in less affluent schools. Therefore, students in African language schools who are observed to exert added effort outside of school are likely to be self-motivated and possibly stronger students. However, although receiving frequent homework improves performance in English/Afrikaans schools, those students who spend longer than is likely expected on their reading homework appear to be those students that find the work most challenging. In addition to homework, daily reading activities of the student also have a positive and significant impact for the sample of African language testing schools.

Two PIRLS generated variables indicating early reading activities and feeling of safety at school were also included in the regression model. A high index of early reading activities – which may be a measure of school readiness - has a positive and significant impact of 16 points for students attending English/Afrikaans schools. The impact is insignificant for students attending African language schools. A moderate or high feeling of safety at school is observed to have a positive and significant impact on reading test scores in African language schools (7 and 21 point increases).Regarding students attending English/Afrikaans schools, the effects are of a similar magnitude at20 points. Parent education has a positive and significant impact on reading test scores. The positive impact of a father having at least a matric certificate is estimated to be 10 points in both school samples. It is, however, clear that mother's education has a larger impact on reading test performance. The impact of a mother possessing at least a matric certificate is an increase in the expected test score of 11 or 13 points. The finding that mother's education matters more for schooling outcomes is consistent with the findings of other studies. The impact of household SES on reading scores is positive and significant across both regressions, with the estimated impact stronger for English/Afrikaans schools (14 point increase for a 1 standard deviation increase in household SES) than for African language schools (4 point increase for a 1 standard deviation increase in household SES). It is noteworthy that the effect of pupil household SES on reading scores is substantially reduced after controlling for school level variables. Although student SES is important for determining schooling outcomes, it would appear that the average SES of the school a child attends has a much bigger impact.

If the student's mother is observed to speak the language of the test at home, this translates into a 20 point increase (statistically significant) in the expected score in the sample of African language schools. The impact in English/Afrikaans schools is a 12 point increase. The presence of more than 10 books in the home leads to an expected increase of 16 points for the English/Afrikaans school sample, and no significant impact for the African language sample of schools. Finally, the employment status of the parents plays a positive and significant role in determining performance outcomes, with the

largest coefficient observed on the dummy indicating that both parents are in full-time employment. However, adjusted Wald tests reveal that there is no significant difference in the coefficients on the two parent employment variables between samples.

The only school-level covariates estimated to have a significant impact on the reading scores of students in African language schools were urban location of the school (positive 24 points), index of time spent by principal on management activities (4 point increase for every 1 standard deviation increase), and close to universal participation of students in extended instruction time (positive 11 points). This last variable is a significant finding if we refer back to the school effectiveness framework of Heneveld and Craig where "high time-in-school" is cited as one of the enabling conditions for school effectiveness. In the case of English/Afrikaans schools, school SES is observed to have a significant convex relationship with reading performance; that is, reading scores increase with school SES at an increasing rate. A moderate absenteeism problem has a significant effect of decreasing expected reading scores by 28 points in English/Afrikaans schools. English/Afrikaans schools located in suburban areas tend to perform significantly worse than schools in urban or rural areas. A 1 standard deviation increases in the time spent by the principal on management activities results in a 5 point increase in expected scores. Parent involvement has a significant and large positive impact on performance in English/Afrikaans schools, resulting in a 63 point increase, or half a standard deviation increase in expected performance. It is important to note that it may not be parent involvement itself that promotes student performance, but rather it represents an important supporting input for promoting school effectiveness.

A number of classroom and teacher variables were further included in the model in order to capture the impact of various teaching/learning processes on performance, as well as the impact of certain teacher level inputs regarded as being important for school climate and enabling school effectiveness. Large classroom sizes have a significant negative impact on expected performance in African language schools (-15 points), whereas no significant impact in English/Afrikaans schools. This may illustrate that affluent schools have the capacity to deal with larger class sizes, whereas this constraint has yet to be overcome by poorer schools. Little can be inferred from the coefficients on teacher demographic variables such as gender and age. However, the estimates suggest that, in African language testing schools, there is a positive impact on expected reading scores for male reading teachers and younger teachers. In the English/Afrikaans school sample, there is no significant gender or age impact of the reading teacher. Estimates on teacher experience indicate that, all else constant, students taught by less experienced teachers (1 to 5 years of teaching experience) are expected to perform between 18 (African school sample) and 37 (English/Afrikaans school sample) points better. This result may reflect an improvement in the quality of teacher qualifications post democracy.

Teacher collaboration only comes through positive and significant in the English/Afrikaans testing sample of schools, contributing 18 points to performance. Teacher qualifications are estimated to have a significant positive effect on performance in English/Afrikaans testing schools, where children taught by taught by teachers with a degree or predicted to perform on average 58 points higher.

The impacts of different classroom activities/teaching aides are significantly different between the two groups of schools. Teaching materials such as reading series and longer reading books have a positive and significant impact on expected reading scores in English/Afrikaans schools, adding between 25 and 38 points. Diagnostic testing has a significant positive impact on reading scores in African language schools, increasing the expected score by 13 points. Teaching methods are further divergent in their impact. The impact of homework – thought to be a measure of student effort – on performance has already been analysed. We may further be interested in pupils' own reporting of class work, as this may be a measure of in-school-time effort and motivation. Frequent class exercises (either working in a worksheet or answering questions aloud) have a positive and significant impact on performance in African language testing schools, adding between 13 and 16 points to expected test scores. Interestingly, controlling for all other factors in the model, teacher reporting of frequent worksheet exercises only has a positive and significant impact on test scores in the sample of English/Afrikaans schools. This may reflect the different way in which children are motivated in the two schools. Discussion amongst the students has a positive and significant impact in African language schools (18 points), and a *negative* and significant impact in English/Afrikaans schools (-32 points). Regular oral feedback from the students has a further positive and significant impact in English/Afrikaans schools, adding 24 points to expected performance. As with parent involvement, the impact of these classroom activities are more likely related to the enabling conditions and social context of the classroom environment, and therefore may not be necessarily attributable to the activities themselves. Returning to the summary statistics in table 1 of the appendix, only half of the teachers in English/Afrikaans schools report using student discussion as a weekly teaching exercise (far below the ratio reporting worksheets and oral feedback), yet 72percent of teachers in African language schools report the same activity weekly. Student discussion may enhance learning in low-SES schools as it contributes to a supportive learning environment, whereas in high-SES schools it may serve little instructive purpose.The learning goals of schools (and more likely the parents of students attending those schools) may differ substantially based on the social context of the school. If high SES parents prefer intellectual/academic goals to be stressed, then this will be reflected in the curricula and activities offered to students. Furthermore, a teacher's choice of class assessments may depend on their expectations of student ability, which may itself be based on student socio-economic background.

6. Conclusions

This study sought to understand the factors that account for poor test performance in the poor (mostly black) part of the school system relative to the affluent part of the school system. This was done using the education production function technique, whereby PIRLS 2006 test reading scores were regressed on various pupil, family, school, teacher and classroom inputs for two separate samples of schools – English/Afrikaans testing schools and African language testing schools. A framework of school effectiveness per Heneveld and Craig (1996) was used as a basis for understanding the role of social context and school factors – climate, enabling conditions and teaching/learning processes – to achieving school effectiveness.

The regression model results reveal that family and student characteristics are undoubtedly important for performance. Parent education, parent employment, household SES and language spoken at home were the most important factors positively influencing performance in English/Afrikaans testing schools. For the sample of students in African language schools, parent education, parent employment, and a students' own effort and reading activities were observed to be the most influential factors. At the level of the school and classroom, extended instruction time, regular classroom effort from the student, diagnostic testing and teacher qualifications were significant for learning in African language schools, whereas high time spent by principal on management duties, parent involvement, school SES (which may be a proxy for other enabling conditions and support inputs), the use of more technical reading tools, oral student feedback, choice of reading book and teacher qualification were more relevant for English/Afrikaans schools. The reason why certain school and classroom processes may not come through significantly in the less affluent black schools, but come through strong and positive in affluent schools, may be a lack of enabling conditions such as effective leadership, flexibility and autonomy, and a capable teaching force. The same holds true for parent involvement. There are constraints that less affluent schools face which inhibit effectiveness, as "where communities are poor, have few material resources, and do not speak the language of instruction in their homes, there are few options to supplement the quality of teaching and learning in their schools" (Christie et al, 2007: 101).

To put the issue of social context into another perspective: Figure 2 of the appendix depicts the test score distribution of the two school types, with students further separated by socio economic status. Low SES students were defined as having household SES found 1 standard deviation below average. From the graph it is clear that low SES students perform below their more affluent peers. This is most likely a direct result of a lack of supporting inputs. It is further evident that low SES students who attend historically more affluent schools (English/Afrikaans school group) are, at least on average, at a

clear advantaged relative to their socio-economic equals in the poorer part of the school system. The distribution of performance for low-SES students in the affluent schools is clearly bimodal, illustrating that some students, despite attending a historically affluent school, perform below average (less than 300 points), whereas others are performing above average. Clearly affluent schools are effective for the most affluent students, but not all poor students are able to benefit from the inputs of these schools, either because the school may lack the factors contributing to effectiveness, or the child lacks the background characteristics and support inputs necessary. Therefore, it needs to be borne in mind that social contexts are more significant than school effects in influencing student outcomes. Nonetheless, schools do have effects, and it may be worth noting that "it is certainly better to attend an effective than an ineffective school" (MacBeath & Mortimore, 2001).

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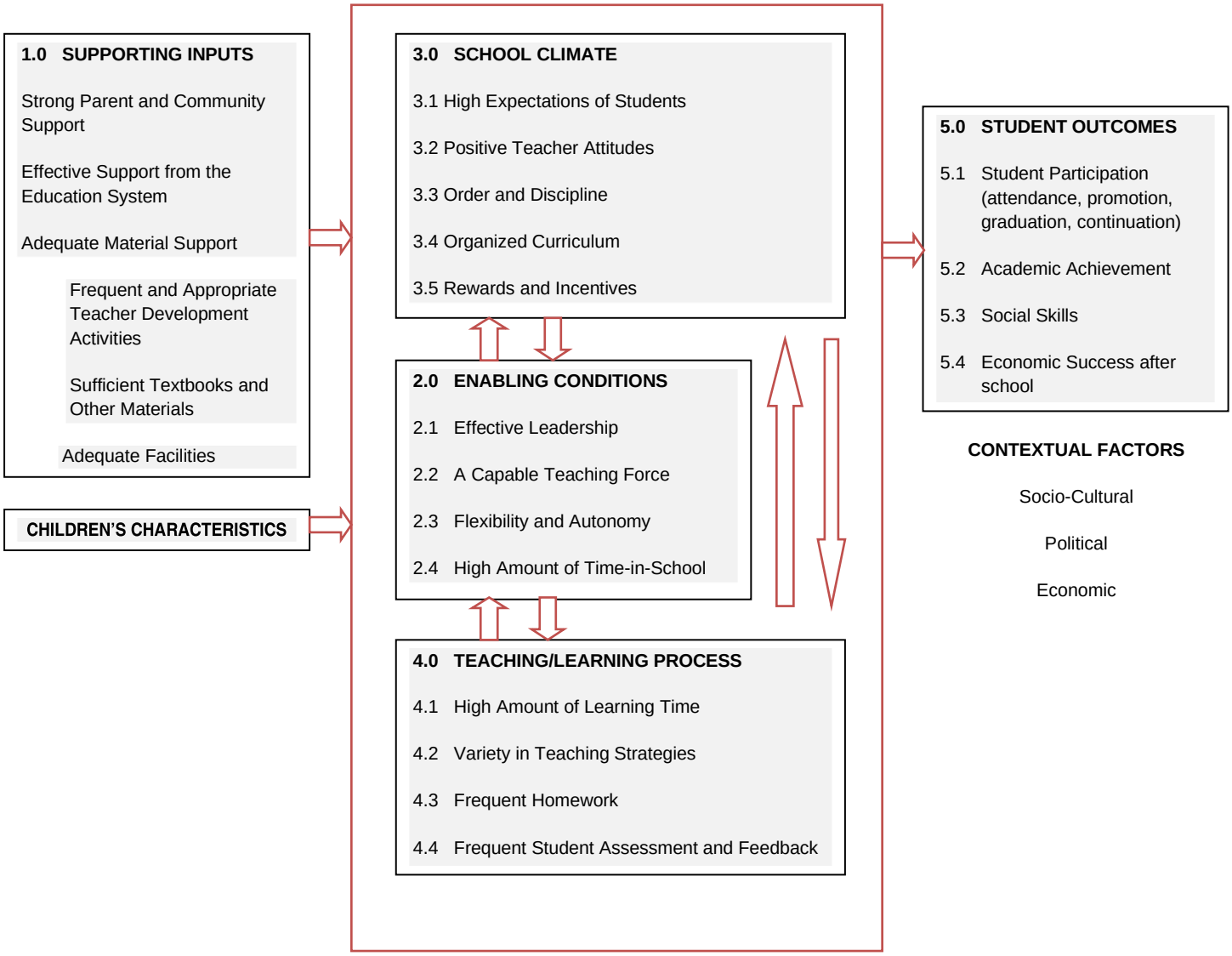
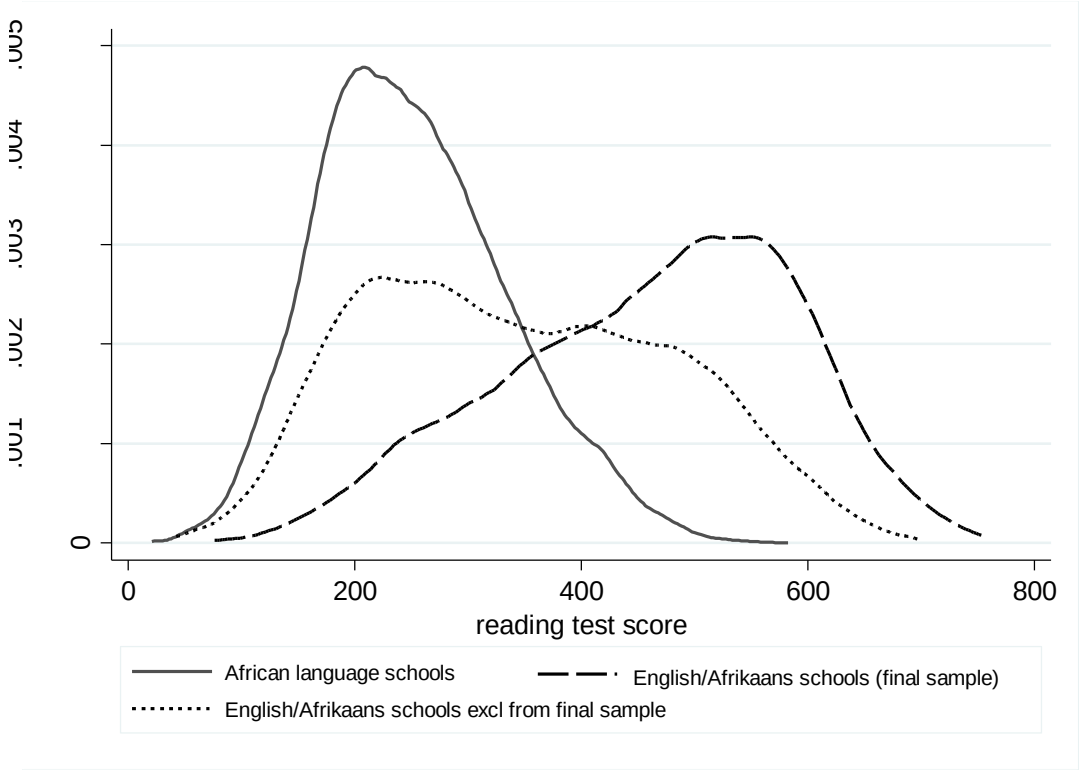
Appendix

Figure 1: School factors related to effectiveness.



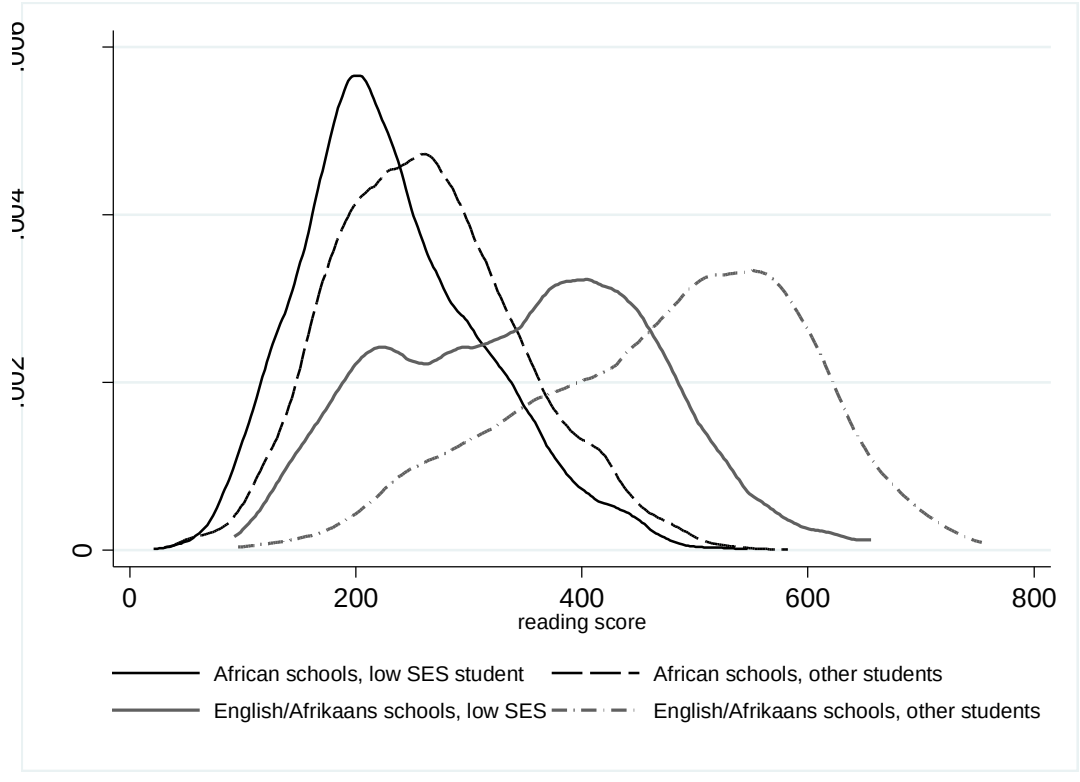
Source: Heneveld & Craig (1996)

Figure 2: Reading test score distribution by school type



Note: own calculations using PIRLS (2006)

Figure 3: Reading test score distribution by school type, and student SES



Note: own calculations using PIRLS (2006

Table 1: Summary statistics of model variables

	African language testing schools				English/Afrikaans testing schools			
Variable	**Mean**	**S.D.**	**Min**	**Max**	**Mean**	**S.D.**	**Min**	**Max**
Dependent variable: reading score	251.5	83.6	20.8	582.5	464.6	125.2	92.2	753.6
Pupil/household								
Overage	0.54	0.50	0	1	0.17	0.37	0	1
Underage	0.07	0.26	0	1	0.05	0.22	0	1
Female	0.51	0.50	0	1	0.53	0.50	0	1
Speak test language always	0.53	0.50	0	1	0.56	0.50	0	1
Speak test language sometimes	0.15	0.36	0	1	0.33	0.47	0	1
Watch >5 hours of tv per day	0.35	0.48	0	1	0.30	0.46	0	1
Spend >5 hours on computer per day	0.20	0.40	0	1	0.21	0.41	0	1
Parent/s help with homework	0.17	0.38	0	1	0.32	0.46	0	1
Student does homework more than once a week	0.35	0.48	0	1	0.40	0.49	0	1
Spend >1 hour on reading homework	0.18	0.38	0	1	0.18	0.38	0	1
Borrow books in test language from library	0.24	0.43	0	1	0.44	0.50	0	1
High feeling of safety at school	0.23	0.42	0	1	0.24	0.42	0	1
Moderate feeling of safety at school	0.67	0.47	0	1	0.70	0.46	0	1
Mother has at least matric	0.21	0.40	0	1	0.50	0.50	0	1
Father has at least matric	0.19	0.39	0	1	0.50	0.50	0	1
Mother speaks test language always at home	0.45	0.50	0	1	0.62	0.49	0	1
Parent reads for more than 10 hours a week	0.13	0.33	0	1	0.18	0.39	0	1
High index of early reading activities	0.39	0.49	0	1	0.52	0.50	0	1
Household SES	-0.27	0.94	-1.74	1.70	0.78	0.86	-1.74	1.70
More than 10 books at home	0.33	0.47	0	1	0.65	0.48	0	1
Pupil reads magazines daily	0.66	0.47	0	1	0.72	0.45	0	1
Both parents work fulltime for pay	0.05	0.21	0	1	0.30	0.46	0	1
One parent works fulltime for pay	0.19	0.39	0	1	0.30	0.46	0	1
School								
School average SES	-0.47	0.85	-3.01	1.27	1.34	0.90	-0.81	2.75
School average SES^2	0.94	1.48	0.00	9.07	2.62	2.24	0.00	7.54
Moderate absenteeism	0.34	0.47	0	1	0.17	0.38	0	1
Severe absenteeism	0.19	0.39	0	1	0.12	0.32	0	1
Urban	0.16	0.37	0	1	0.17	0.37	0	1
Suburban	0.12	0.32	0	1	0.47	0.50	0	1
>75% of students take part in extended instruction time	0.09	0.29	0	1	0.12	0.32	0	1
High parent involvement	0.56	0.50	0	1	0.94	0.24	0	1
No students on free/reduced cost lunch programme	0.33	0.47	0	1	0.62	0.49	0	1
Time principal spends on management tasks (minimum 0, standard deviation = 1)	1.20	0.92	0	5.69	1.38	0.96	0	4.38
Classroom/teacher								
Class size > 30 pupils	0.80	0.40	0	1	0.68	0.47	0	1
Teacher has degree	0.26	0.44	0	1	0.24	0.42	0	1
Teacher has diploma	0.50	0.50	0	1	0.68	0.47	0	1
Pupil reports working in worksheets after reading at least once a week	0.81	0.39	0	1	0.79	0.40	0	1

Pupil reports answering questions aloud following reading in class	0.50	0.50	0	1	0.29	0.45	0	1
Pupil is able to choose to read their own choice of book in class	0.69	0.46	0	1	0.87	0.33	0	1
Reading series used in class	0.58	0.49	0	1	0.55	0.50	0	1
Long books with chapters used in class	0.03	0.16	0	1	0.13	0.34	0	1
High teacher collaboration	0.15	0.35	0	1	0.38	0.49	0	1
Teacher reports giving worksheets after reading at least once a week	0.87	0.34	0	1	0.77	0.42	0	1
Teacher reports students discussing their reading amongst themselves in class at least once a week	0.72	0.45	0	1	0.49	0.50	0	1
Teacher reports asking for oral feedback of reading from students as least once a week	0.81	0.39	0	1	0.68	0.47	0	1
Diagnostic tests emphasised in class	0.37	0.48	0	1	0.13	0.34	0	1
Male reading teacher	0.31	0.46	0	1	0.25	0.44	0	1
Teacher <30 years old	0.01	0.12	0	1	0.05	0.21	0	1
Teacher 30 – 39 years old	0.45	0.50	0	1	0.36	0.48	0	1
Teacher 40 – 49 years old	0.30	0.46	0	1	0.38	0.45	0	1
Teacher 50 – 59 years old	0.16	0.37	0	1	0.29	0.45	0	1
Teacher has 1-5 years experience	0.10	0.30	0	1	0.07	0.26	0	1
Teacher has 6-15 years experience	0.50	0.50	0	1	0.35	0.48	0	1
Teacher reports giving reading homework at least once a week	0.73	0.44	0	1	0.67	0.47	0	1
WC	0.02	0.12	0	1	0.36	0.48	0	1
NC	0.002	0.04	0	1	0.08	0.27	0	1
FS	0.06	0.23	0	1	0.02	0.15	0	1
KZN	0.22	0.41	0	1	0.17	0.37	0	1
NW	0.08	0.27	0	1	0.02	0.15	0	1
GAU	0.12	0.32	0	1	0.23	0.42	0	1
MPU	0.09	0.29	0	1	0.02	0.15	0	1
LIM	0.17	0.37	0	1	0.01	0.10	0	1

Note: own calculations using PIRLS (2006)

Table 2: Multivariate OLS regression results

	Specification 1		**Specification 2**		**Specification 3**		**Specification 4**	
	Eng/Afr	**African**	**Eng/Afr**	**African**	**Eng/Afr**	**African**	**Eng/Afr**	**African**
Student/household								
Overage	-45.9074**	-23.8372**	-41.5066**	-17.4934**	-38.5152**	-17.0252**	-36.3231**	-18.3275**
	9.361	3.555	7.4016	2.8671	6.233	2.7723	5.8929	2.4976
Underage	-19.0634~	-34.5505**	-17.1321~	-23.1744**	-12.6097	-22.2698**	-10.5172	-21.0614**
	10.278	5.8598	9.3483	4.7862	8.031	4.5838	7.5147	4.1541
Female	22.4381**	25.9632**	21.4225**	26.3753**	21.8898**	26.8166**	21.2722**	25.866**
	4.9795	2.231	4.934	2.1357	4.7394	2.011	4.0145	1.9501
Speak test language often	33.9107**	5.5732	33.5895**	12.0919**	26.6142**	11.9506**	23.6875**	10.7594**
	9.98	3.6822	9.0746	3.0522	6.1432	2.9944	5.4804	2.8589
Speak test language sometimes	50.653**	9.8368**	48.0971**	11.0028**	33.2527**	10.6384**	28.9637**	10.5499**
	8.9123	4.2825	8.2899	3.5888	5.8623	3.5406	5.6998	3.1959

Watch >5 hour tv/day	-29.2454**	-8.6162**	-29.6932**	-9.0459**	-17.1328**	-8.9673**	-15.0979**	-9.9691**
	5.7886	2.5418	5.6063	2.3406	4.6421	2.2781	4.6666	2.177
Spend >5 hours on computer/day	-16.7314**	-17.09**	-16.53**	-17.7876**	-12.5786**	-17.5015**	-11.0328**	-17.9891**
	4.4811	2.6995	4.3349	2.3334	3.6808	2.2809	3.5072	2.1538
Parent helps with homework	4.5649	7.7238*	3.7854	8.85**	-4.1667	8.0386**	-3.1517	6.4555**
	4.3898	3.5081	4.6371	3.0864	3.932	3.0131	3.7543	2.622
Do homework more than once a week	7.9643	17.8445**	7.4638	18.2025**	-1.7468	18.0776**	1.2855	17.6951**
	6.9518	2.6753	7.4949	2.6055	5.5229	2.4972	4.9076	2.2072
Spend >1 hour on reading homework	-24.3878**	12.461**	-24.0949**	9.9514**	-13.4066**	9.1791**	-10.9896*	7.8551**
	5.7514	2.945	5.2752	2.8384	5.2364	2.7037	4.5745	2.4784
Borrow books in test language	-2.0411	10.4873**	-0.273	11.2888**	-6.8159	10.2494**	-1.4529	8.3097**
	5.9857	2.7616	6.1408	2.4589	4.7051	2.3786	3.605	2.1972
High feeling of safety at school	27.69**	21.8545**	26.1205**	23.9372**	17.2207**	22.1785**	20.9527**	20.4608**
	5.9539	4.7694	6.2787	4.7981	6.6453	4.8198	6.6096	4.3472
Moderate feeling of safety at school	21.0703*	9.4077*	19.5285*	10.4165*	16.9097*	8.1888*	19.784**	8.0876*
	8.6748	4.0187	8.7429	4.0499	7.3386	4.0215	6.931	3.8397
Mother has at least matric	45.002**	12.4164**	39.8452**	12.2033**	14.9393**	11.2966**	13.2553**	11.037**
	8.6668	3.3173	8.1257	3.0955	6.0964	2.9948	5.5608	3.0269
Father has at least matric	28.5271**	11.5978**	25.6623**	9.3849**	11.6867~	9.1188**	9.3948~	9.6812**
	7.2516	2.8903	5.9644	2.7275	6.048	2.7284	5.7943	2.7942
Mother speaks test language	31.4226**	17.4532**	31.0471**	21.6958**	17.8844**	21.1835**	14.8691*	19.6671**
	13.7379	4.2397	9.4751	3.5284	6.7295	3.3159	6.4528	3.307
Parent reads >10 hrs/week	6.101	-1.4106	5.1348	5.3583	6.7677~	5.8017~	5.8912~	4.0392
	4.1702	3.3547	4.3614	3.2702	3.5748	3.2612	3.3938	3.0792
High early reading activity index	21.1821**	1.1496	20.4986**	3.2678	17.451**	3.2148	15.6862**	2.4529
	5.8338	2.4059	5.481	2.3354	5.0275	2.2373	4.8142	2.007
Household SES	38.1743**	12.2539**	37.0903**	7.9682**	13.2513**	4.8181**	13.5509**	4.2304**
	4.0829	1.7182	4.318	1.635	3.663	1.1648	3.5579	1.1718
>10 books at home	29.2941**	1.2505	28.0082**	-3.118	18.0234**	-3.5064	16.143**	-2.6523
	5.5818	3.6249	4.768	3.5813	4.6545	3.2766	4.0475	2.5211
Read magazines daily	-10.1299	7.7797**	-6.1659	8.0283**	3.0474	7.8504**	3.7007	5.6979**
	6.5782	2.4913	6.2832	2.3451	4.2975	2.2199	4.0328	2.0268
Both parents work fulltime for pay	30.079**	16.8421**	26.1759**	14.3182**	13.3212*	13.1664**	12.104*	10.8895*
	7.549	5.823	7.0996	4.8292	5.3242	4.6794	5.2023	4.5912
One parent works fulltime for pay	17.5355**	9.0532**	16.4021**	7.3082**	8.8313~	6.9508**	7.7054	5.6568*
	5.6045	3.1446	5.0624	2.7975	4.6997	2.7422	4.974	2.589
School-level								
School SES					34.6049*	9.3167~	29.408*	7.5547
					15.0562	5.4672	13.9259	5.3105
School SES squared					13.8246*	1.3594	13.6407**	-0.2145
					6.9974	2.6962	5.4439	2.9151
Moderate absenteeism problem					-12.6921~	-4.8145	-27.5151**	-5.2635
					6.7137	5.0785	7.9946	4.4138
Severe absenteeism problem					-16.686	-6.49	2.5723	-3.9726

			11.9979	7.2296	9.9336	6.5102
Urban			-8.1099	23.0311*	8.0155	24.4227*
			10.5379	9.9668	8.1042	9.7493
Suburban			-32.3395**	4.6554	-39.3432**	6.8884
			7.8083	8.0992	8.7666	6.4774
>75% of students take part in extended instruction time			14.6272	6.2469	-14.7757	11.0187*
			11.9993	5.5114	9.4728	5.4125
Parent involvement			24.6445**	0.4711	62.5519**	2.9824
			7.4619	4.9296	12.4474	4.183
No students on free/reduce cost lunch programme			-3.4093	-3.1798	-2.1268	4.5423
			7.6892	6.8539	7.8007	6.426
Time spent by principal on manamagement tasks			6.1778~	3.777~	5.2337*	3.9033~
			3.3942	2.2948	2.3787	2.0592
Classroom/Teacher level						
Class size> 30					-5.8692	-15.1901*
					5.8689	6.8967
Teacher has degree					57.9577**	12.6766
					23.6514	8.3885
Teacher has diploma					35.604	-0.9168
					23.2053	7.023
Pupil reports working in worksheets more than once a week					-2.8739	15.7758**
					5.1422	3.1466
Pupil reports answering questions aloud after reading more than once a week					-12.2159**	12.6687**
					3.4103	2.1902
Reading series used					24.6953**	0.2221
					6.4405	3.9641
Books with long chapters used					37.8368**	-4.7857
					6.6748	8.7685
High teacher collaboration					18.0348**	10.9481
					6.3444	6.8609
Teacher reports giving reading homework weekly					27.8594**	-4.4244
					7.2707	6.1792
Teacher reports giving worksheets weekly					19.757**	7.5124
					6.168	7.811
Teacher reports students discussing reading weekly					-31.9103**	17.3623**
					5.9373	6.4219
Teacher reports oral feedback of reading weekly					23.6315**	-3.3387
					7.0895	7.8822
Diagnostic tests emphasized					-13.3149~	12.9877**
					7.1293	4.4619
Teacher male					0.4796	7.7593~

							8.0894	4.5756
Teacher <30							-0.3996	47.621**
							20.6392	13.9306
Teacher 30-39							0.4897	-11.0809
							17.8311	9.8659
Teacher 40-49							18.4108	-13.6806~
							17.0128	7.7357
Teacher 50-59							27.3496	-21.6931**
							17.4503	7.9971
Experience <6 years							37.4588**	17.479*
							13.4735	8.8442
Experience 6-15 years							12.9694*	5.3663
							5.9405	7.6093
WC			7.6552	41.1571*	46.7741**	18.0695	59.439**	32.2333
			35.4165	21.0219	18.983	22.8716	16.6208	29.3705
NC			-21.8317	-14.3392**	18.2059	-55.3806**	38.2009*	-24.5328
			37.1222	5.219	19.6045	15.542	16.5997	18.4386
FS			-6.7272	87.3036**	43.2926*	67.428**	108.5473**	70.7114**
			37.2952	8.0981	22.9427	10.5453	33.6241	10.8119
KZN			24.1247	42.8548**	61.2674**	38.96**	59.5896**	46.7249**
			39.5404	7.8909	26.8119	9.1935	18.2132	7.5692
NW			-8.6735	61.9682**	59.6628**	47.8718**	81.5468**	54.0066**
			37.3816	12.2291	22.0709	14.2042	20.3313	14.5867
GAU			31.753	52.0136**	66.2785**	25.5343*	89.3439**	27.4971*
			34.611	8.133	20.2385	12.4258	21.1008	12.1979
MPU			-34.1063	36.6531**	-3.7386	24.7635**	41.2053~	40.8826**
			58.9123	7.1213	23.9228	9.0706	24.0008	10.0586
LIM			33.612	45.1984**	50.7444*	35.0234**	50.2204*	45.0802**
			39.4384	7.7228	23.7121	8.7533	22.4785	8.6055
Constant	281.0643**	215.7374**	278.845**	165.7364**	227.6546**	174.4262**	81.8012*	144.1719**
	21.4176	6.7344	42.0305	7.799	28.7968	11.3949	44.8662	16.0106
Observations	2107	9134	2107	9134	2107	9134	2107	9134
R-squared	0.56	0.21	0.58	0.28	0.69	0.29	0.72	0.34

Note: own calculations using PIRLS (2006).

*** denotes 1% level of significance, * denotes 5% level of significance, ~ denotes 10% level of significance*