Educational Equity: Fiscal Incidence and Socio-Economic Gradients

Public Expenditure Analysis for the Department of Basic Education: **Report 3**

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June 2012



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Executive summary

- *Historically, SA had a highly unequal education system, divided along racial lines, with massive fiscal differentials in spending on children from different race groups.*
- *Earlier fiscal incidence analysis has shown that most of the current spending differentials had been eliminated by 2000. (This report does not consider the large remaining backlogs in infrastructure spending, which is deal with in the Infrastructure Report.)*
- *This analysis shows that there were virtually no spending differentials remaining by 2006. The remaining differential at a racial level largely result from the fact that teachers in more affluent schools are generally better qualified and therefore earn higher salaries. For this reason also, there are similar differentials in spending per pupil between black pupils in higher and lower quintiles, probably also reflecting differences in teacher qualifications between urban and rural schools.*
- *One remaining differential, however, is that in spending on non-teacher personnel. Many formerly white schools historically have had such personnel paid from public funds, while the same does not apply to former black schools.*
- *There are still large performance differences between different parts of the school system. These differences may have their origin in fiscal spending differences, in private spending, in the effect of home background, or in efficiency differentials between schools.*
- *Education production functions using regression analysis over a large number of studies have consistently shown that neither resource differentials nor learner socio-economic status can account for the large remaining differences in performance. This implies that the remaining gap must be ascribed either to efficiency differentials or to an unobserved aspect of home background not captured by socio-economic status, such as motivation or influence of parental factors on education.*
- *Section B of the analysis investigates this aspect by analysing benefit incidence, as opposed to simply expenditure or fiscal incidence. A number of different strategies are employed to determine whether efficiency differentials between schools in lower quintiles and those in the top two quintiles can be estimated.*
- *The first method employed is a Oaxaca-Blinder decomposition based on the TIMSS data for mathematics. The TIMSS Grade 8 Maths test score was regressed on three measures of SES, the amount of time a student spent on homework – proxying for learner effort –, and a dummy variable indicating whether the student's Maths teacher had a degree, an indication of school resources. Separate regressions for the two groups of schools indicate that differences in endowments, mainly SES, account for just more than half of the gap in achievement between relatively affluent schools (top quintile) and the rest.*

Less than ten per cent of the differences in performance can be ascribed to differences in resources (qualifications of Maths teachers). The largest part of the performance difference is due to the difference between regression intercepts for the two groups, which implies that children attending more affluent schools achieve at a higher level before differences in private and public resources are considered. This may be reflecting the higher efficiency of conversion of inputs into outputs in more affluent schools.

- *Another way of arrive at benefit incidence is to estimate what benefits a representative individual learner would receive in terms of gain scores or value added from attending different schools across the quintile distribution. Lemieux decompositions are one way of arriving at such estimates. Applying such analysis to the more difficult numeracy questions in the National School Effectiveness Study (NSES) shows that a much greater learning gain (22.7 points) between Grade 3 and Grade 5is made by learners in Quintile 4 and 5 schools than in other schools (12.8 points).*
- *The analysis thus far has shown that only minor fiscal inequities remain, but that differential efficiency of spending implies that there are still large differences in benefit incidence, i.e. the more affluent still gain much more from the school system.*
- *Another form of inequity that is investigated relates to private spending on education. Since the Hunter Report there has been emphasis on school fees as a way for schools to supplement resources from parental contributions through school fees. In the past few years such school fees have been abolished for schools in the poorest three quintiles of the distribution.*
- *An analysis of the HSRC household survey, undertaken amongst other things to provide more accurate data on the cost of education to households, shows that aggregate education spending tends to be regressive, i.e. that it makes up a higher proportion of income amongst poorer groups. However, although school fees had not been abolished at the time, it transpires that schools fees were a relatively small part of overall education spending per learner amongst the poorest quintiles of households, generally constituting at the time less than one-fifth of all household spending on education in the bottom three quintiles of the household distribution. Thus the abolition of school fees in schools most frequented by the poor would have had only a minor effect on the financial situation of such households, an annual amount equivalent to only about one month's child support grant in the case of households receiving such grants.*
- *In contrast to this, school uniforms are a more regressive expenditure item with larger consequences for the poor.*
- *After reviewing the major trends in South African schooling outcomes, Section D discusses reasons to expect socio-economic status to have a significant impact on learning outcomes. Although in virtually every society poorer children are at an educational disadvantage, the extent to which children from disadvantaged backgrounds have a real opportunity to achieve educational outcomes that will enable them to be*

successful in the labour market is one indication of whether the school system can be expected to transform existing patterns of inequality or merely reproduce them.

- *The analysis of various educational achievement data, using socio-economic gradient techniques, indicates that socio-economic status has a particularly strong effect on achievement in South Africa relative to most other countries. This analysis also reveals that poor South African children are performing worse in reading and mathematics than equally poor children elsewhere in Southern and East Africa. This might be interpreted as evidence that South Africa still has room to improve efficiency and raise performance to a level nearer to the constraint imposed by poverty. Similarly, a comparison of provincial educational achievement demonstrates that some provinces are under-performing relative to their level of poverty.*
- *The Section then presents analysis to demonstrate the crucial role that schools play in mediating the effect of socio-economic status. The average socio-economic status of a school clearly has a larger impact on an individual's educational achievement than own home background. The effect of socio-economic status on educational achievement in South Africa can therefore be thought of as a two-step process: home socio-economic status is crucial in determining which part of the school system one enters; then for those in historically black schools the prospects of achieving high quality educational outcomes are bleak, regardless of home socio-economic status.*
- *The Section then attempts to track educational inequality throughout the school programme. By the time children enter formal schooling large gaps already exist in the cognitive ability of more and less affluent children. The school system is not managing to reduce these inequalities, and if anything, there appears to be divergence in achievement between rich and poor learners over time. To a large extent this is due to the fact that all learning builds on prior foundations and in many primary schools the quality of early grade literacy (especially reading) and numeracy teaching is leaving children with untenable learning deficits.*
- *A final section examines how well the officially used classification of schools into "poverty quintiles" corresponds to survey-based measures of school socio-economic status. The conclusion is that this remains a meaningful classification for policy purposes both in terms of distinguishing between the socio-economic status of schools and the performance of schools.*

Contents

Executive summary i
Introduction: On equity in education 2
SECTION A: MAPPING TRENDS IN THE INCIDENCE OF SCHOOL EXPENDITURE IN SOUTH AFRICA BEYOND 2000 4
INTRODUCTION 4
A BRIEF LITERATURE REVIEW ON EXPENDITURE INCIDENCE 6
ANALYSIS OF THE INCIDENCE OF SCHOOL SPENDING, 2005: METHODOLOGY 9
INCIDENCE OF SCHOOL SPENDING, 2005 12
Conclusion on spending incidence 20
SECTION B: BEYOND EXPENDITURE: BENEFIT INCIDENCE ANALYSIS 21
EXTENDING THE ANALYSIS: DECOMPOSITION ANALYSIS APPLIED TO EDUCATION DATA TO DETERMINE HOW MUCH RICH AND POOR BENEFIT FROM THE EDUCATION SYSTEM 21
Oaxaca-Blinder method 22
Alternative decomposition methods 26
Conclusion 32
SECTION C: PRIVATE SPENDING ON EDUCATION AND EQUITY 34
Introduction 34
Education spending data from the HSRC Survey of 2004 34
School fees: 35
Source: Own calculations from HSRC Survey 37
Conclusion 40
Household spending per primary learner by quintile and expenditure item **Error! Bookmark not defined.**
Household spending per secondary learner by quintile and expenditure item **Error! Bookmark not defined.**
Section D: Equity in South African schooling: An analysis of social gradients 41

Educational outcomes in South Africa: The context 41
Literature Review: Socio-economic status and educational outcomes 43
The socio-economic gradient in South Africa 48
The effect of socio-economic status mediated through schools 55
What happens to educational inequality as children progress through school? 62
BIBLIOGRAPHY 73

1

Introduction: On equity in education

The topic of equity in education has generated much discussion and analysis all over the world. South African history adds a further dimension to this debate, for the inequality that is so deeply entrenched in South African society is rooted in inequality in education, whilst education is also perceived to be a potentially powerful instrument for reducing inequality.

After the political transition, the first democratically elected government was tasked with reunifying a highly fragmented education system, composed of subsystems with greatly differing access to resources as well as highly variable levels of functionality. This required a comprehensive overhaul of the education system, including a large-scale redistribution of teacher and other resources. Almost two decades later, most of the required fiscal shifts have been completed, but many longer term school resourcing and quality challenges remain. South African learners' weak performance on both international and national tests attests to the fact that inequalities in education quality may be much more difficult to eliminate than disparities in resource levels.

This report considers equity from different perspectives. Section A deals with fiscal or expenditure incidence, with the focus on how fiscal resources are distributed across rich and poor learners and learners from different groups, and then extending this analysis to how well fiscal resources for education are distributed across rich and poor *households*. But today, despite the virtual equalisation of fiscal resource spending in schools, there is still massive inequality in educational outcomes. This reflects the fact that home backgrounds differ substantially, but also (and for South Africa more importantly) because efficiency levels (the ability of the school system to convert resources into outcomes) differ vastly across different schools. Thus Section B extends this analysis of fiscal resources to also enquire to what extent it is possible to determine *benefit incidence* rather than only *expenditure incidence*: What are the relative benefits that different learners get from education, considering the great inequality in educational efficiency?

While these first two sections deal with respectively equity of fiscal resources and the inequality in the efficiency of resource use in schools, Section C turns to private costs: What economic burden do education costs place on poor households? This is analysed using a household survey that was dedicated to determining this.

Section D, finally, looks at the equity of outcomes along various dimensions, using the technique of social gradients as a way to express how outcomes, inter alia, vary with socio-economic status.

SECTION A: MAPPING TRENDS IN THE INCIDENCE OF SCHOOL EXPENDITURE IN SOUTH AFRICA BEYOND 2000

INTRODUCTION

This section evaluates the expenditure incidence of education spending in South Africa, using fiscal data for 2005. The main focus was to update earlier work by Van der Berg (2005; 2006) for 1995 and 2000, thus providing a longer term evaluation of post-transition fiscal shifts in education.

Under apartheid it was relatively unproblematic to determine how fiscal resources for education were allocated to members of the different race groups, given that such spending was recorded separately. The focus in this early work naturally also mainly fell on racial inequalities, given their large magnitude. Little attention was given to incidence across socio-economic groups.

About two-thirds of the total education budget goes towards school education, which is managed concurrently by national and provincial government. The post-apartheid government inherited a highly fragmented education system made up of subsystems with very different levels of resourcing and operational efficiency. While PTRs were generally relatively low in formerly white schools, they varied greatly and were often high in the less affluent formerly black schools. Government thus decided to equalise the PTR across all schools as part of the education system reunification process. By 2000, this differential had all but disappeared, although *de facto* differences which favour the affluent remain as a result of the additional teachers employed by the SGBs in more affluent (historically white) schools. The pupil-teacher ratio (PTR) is approximately 31, having remained roughly constant since 2000 (National Treasury 2009: 24). The achievement of this PTR level is arguably one of the most significant post-transition educational achievements.

While the racial bias has been eliminated, PTRs still vary somewhat according to school size and geography. The more rural provinces have proportionally more schools with fewer students; for

example the Eastern Cape has 23% of the country's public schools but only 18.3% of students, while Gauteng has 7.4% of schools and 13.5% of students (National Treasury 2006: 13). This results in schools in more urbanised provinces being much larger, on average. PTRs tend to be lower in small schools since teachers with different specialisations are required to teach the core subject mix. While this would tend to work in favour of rural schools, which are often poorer than urban schools, in practice these schools often struggle to fill vacant positions, since teachers are reluctant to work in rural areas, especially remote areas. However, this factor may not necessarily result in unfavourable PTRs in poorer schools. The Department of Education implemented a revised post-provisioning model in 2003, in terms of which provinces allocate up to 5% of teacher posts additionally for poorer schools (National Treasury 2003: 62). This policy aims to create a slight pro-poor bias in the distribution of teachers. Nonetheless, concerns over the quality of teachers serving poorer schools remain, as a substantial number of teachers do not have the minimum qualification of complete secondary school plus three years of tertiary training normally required (this issue is discussed in the report on Teacher Salaries). These teachers are likely to be employed in less affluent schools which may experience difficulty in filling posts otherwise.

Despite the achievements in moving towards an equitable distribution of teacher resources since 1994, stark inequalities in school infrastructure remain, discussed in the report on Infrastructure. The introduction of the National Norms and Standards for School Funding in January 2000 was aimed at redressing historical imbalances in resources through shifting additional non-personnel expenditure – both capital and current – towards schools with the greatest need. The amount of Norms and Standards funding that a school receives depends on which school poverty quintile it falls into, which is determined by the socioeconomic profile of the school students, community location and its infrastructure backlog. The funding formula is such that schools that rank in the poorest quintile should receive seven times the amount per student that schools in the most affluent quintile receive (National Treasury 2003: 65). Schools are able to use this money to pay inter alia for water and electricity, classroom infrastructure, teaching aids and textbooks. While strongly redistributive by design, Norms and Standards funding accounts for a relatively small

portion of overall school funding, comprising approximately half of recurrent non-personnel school spending.

Finally, it is worth noting that recently many of the students attending poorer schools have been benefiting from an additional and expanding form of government spending. By 2005 already the Department of Education's National School Nutrition Programme reached 6 million children, while 10 million learners in approximately 21 000 schools were reached by 2010 (DBE: 2011). The programme aims to reduce short-term hunger and enhance both learning capacity and school attendance.

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A BRIEF LITERATURE REVIEW ON EXPENDITURE INCIDENCE

There is a long literature on expenditure incidence in South Africa that derives from the concern with issues of race and inequality in racial patterns of spending. These studies are summarised in Van der Berg (2006a.) Only with the advent of household datasets did it also become possible to undertake incidence analysis that incorporated incidence across household deciles or quintiles. Almost all these studies focused on aggregate incidence and not so much on school education, the subject of this report. Instead they documented the inequalities in social spending during apartheid times and at the end of the apartheid era. Subsequently there have been only three major studies for National Treasury, investigating the shifts in incidence since the transition. The second of these studies focused on the period 1995 to 2000, and showed dramatic shifts in spending towards the poor, with education spending responsible for a large proportion of these shifts. This was largely a result of the equalisation of PTRs across school (Van der Berg 2005).

More recent work has since been done on spending in education in specific provinces by Fiske and Ladd (2004) (Western and Eastern Cape) and Motala (2006) (Gauteng), while Wildeman (2004) has in a series of papers for Idasa documented many of the policy changes taking place and areas of concern regarding expenditure equity and needs. The most important recent paper in the field of education incidence was that by Gustafsson and Patel (2006), which analysed data for 2005. This study dealt with education spending incidence and the shifts in education spending.

The focus was, however, quite different from the earlier studies dealing with fiscal incidence in education, as the analysis centred on *school* quintiles, rather than what part of the *household* income distribution (*household* quintiles or deciles) benefited from such spending, i.e. how children in the different school quintiles are linked to the household income distribution. In this sense it could not be directly used to establish a link between what is happening at the level of the household, where poverty is manifested, and in the schools, each of which draws children from various socio-economic backgrounds.

There is fortunately no longer a major school access problem in South Africa, thus this does not confound the distributional issue in a way that would negate the value of the Gustafsson-Patel incidence analysis. But focusing on school quintiles does not take into account that different quintiles of the household income or expenditure distribution contain very different numbers of children. Public expenditure on education per child differs from the per capita expenditure per member of the population as a result of the large differences in the ratio of children to adults, and also because household size is larger in the bottom part of the income distribution.

As a result of these factors, it was difficult to compare the analysis by Gustafsson and Patel (2006), valuable as it is, to earlier studies that used household quintiles as a measure of distribution. In these earlier studies the attention fell mainly on distribution across different types of households, since the focus in these studies was on aggregate social expenditure and not only on public spending on school education. In order to make these comparisons, this Section will therefore also rank individuals within household quintiles.

The study by Gustafsson and Patel (2006) demonstrated a considerable shift in resources to poor schools. The spending differential per child between the richest school quintiles, receiving R5284 per annum, and the poorest school quintile, receiving R4757 (only current expenditure considered), was relatively small (see Table 1). This differential has two main sources. On the one hand, teacher salaries in the richer quintiles were still higher than in the lower quintiles, as a result of higher qualification levels and greater experience of teachers in richer schools. This also accords with the findings of Van der Berg (2005). A second source of advantage for the richer

quintiles, and one not captured before in earlier studies because of data constraints, was a difference in the costs of non-teaching personnel. Thus the study by Gustafsson and Patel went beyond what earlier studies had incorporated. They found (Gustafsson and Patel 2006: 71) that almost five times as much (R428) was spent per child on non-teacher personnel spending in the richest school quintile than in the poorest school quintile (R90), largely due to the greater preponderance in richer schools of non-teachers (administrative staff and support staff, such as gardeners). This advantage constituted a large portion of the remaining gap between spending per child in rich and poor quintiles.

In contrast, poorer schools had a slight advantage in terms of the PTRs, as a result of the post-provisioning norms which were introduced to slightly favour poor schools. Poorer schools also benefited more than proportionately from recurrent spending in the form of financial allocations in accordance with the Norms and Standards and even the so called "top slicing" of non-personnel recurrent spending. As a consequence, in overall terms, differentials between poor and rich schools were relatively small.

At the racial level, Gustafsson and Patel (2006: 68) found that spending was still 22% larger per white child than per black child, with the same factors playing a role in this regard. This does, however, represent a massive shift in spending since the time of apartheid: in 1991, 350% more was spent by the state per white child than per black child.

Table 1: Cost per student by school quintile, 2005 (Rand per student)

School quintile	Teacher pay	Non-teacher pay	Norms & standards	Top-slice	Total public current
1	R3 955	R 90	R411	R301	R4 757
2	R4 076	R115	R325	R283	R4 800
3	R4 088	R188	R253	R287	R4 817
4	R4 170	R265	R197	R272	R4 904
5	R4 528	R428	R112	R215	R5 284
Total	R4 103	R202	R273	R276	R4 854

Source: Gustafsson & Patel, 2006: 71, Table 1

ANALYSIS OF THE INCIDENCE OF SCHOOL SPENDING, 2005: METHODOLOGY

The methodology used in the previous studies by Van der Berg essentially hinged on determining teacher costs per child of each race group, allocating this spending to household deciles, and then adding recurrent spending per child obtained from other sources to this. This required a racial breakdown of the different household deciles for valid comparisons. The allocations from race to deciles were largely proportional, with the added assumption that teacher costs per black child were 20% higher in the top three deciles than for the rest of the black population. In the 2005 datasets, more information became available on spending by school quintiles. Two approaches were thus possible: allocating spending per school quintile (where schools were arranged according to the *average* socio-economic status of the students they served), or allocating spending for each race group across household deciles.

However, there was no direct link between school quintiles and household quintiles or deciles, as some rich children may have been in schools serving poorer communities, or more likely, the other way round. In order to deal with this, data at school level needed to be matched to the household income distribution. The approach taken was to combine data for Grade 8 students from TIMSS2003 and the GHS (or General Household Survey) of 2005. Household expenditure data in the GHS were analysed to obtain household quantiles (four household quintiles, with the top or most affluent quintile further divided into two household deciles) for only households containing Grade 8 students. Quintile and decile cutpoints were carried across to the TIMSS dataset, where an absence of income and expenditure data necessitated the derivation of a learner asset index using principal component analysis (PCA). The variables included in the PCA reflected household access to basic services as well as ownership of a range of assets. Students were then ranked by the asset index and divided into quantiles consistent with the household expenditure distribution obtained from the GHS, assuming that the asset index and household expenditure data would yield approximately the same ranking of households, and that this

ranking was unlikely to have changed substantially between 2003 and 2005. [1]School affluence was calculated as the average value of the asset index for students attending a school, and schools in the TIMSS dataset were ranked into quintiles.

Table 2 shows the distribution and matching obtained using this method. Note that there are differing numbers of *children* in each household quintile, but an equal number of *households*.

Table 2: Proportions of Grade 8 students in household and school quantiles, 2005

School Quintile	Household quantile						
	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Decile 9	Decile 10	Total
1	78%	17%	3%	0%	0%	2%	100%
2	51%	37%	10%	2%	1%	0%	100%
3	35%	38%	20%	5%	1%	0%	100%
4	23%	39%	27%	9%	2%	0%	100%
5	4%	15%	25%	23%	20%	12%	100%
Total Grade 8 Students	37%	29%	18%	8%	5%	3%	

Source: Own calculations using TIMSS2003, GHS2005

There had been a considerable improvement in the extent of most of the public school data available for 2005 compared to earlier incidence analyses. Actual spending data by school for most schools were available from EMIS and PERSAL data, as were the racial composition and school quintile. Furthermore, information was also available for the first time on non-teaching personnel costs paid by the state, which considerably favoured richer schools. Consequently, the 2005 fiscal data were not strictly comparable to earlier datasets. This must be taken into consideration when making comparisons; fully valid comparisons with earlier data must thus exclude the non-teacher personnel spending, which constituted 6% of the value of teacher personnel spending. In earlier studies, all personnel spending had been assumed to be distributed similarly to teacher personnel spending, which turned out to have slightly under-estimated the degree of inequity in the overall distribution of school spending. However, as the non-teacher

[1] The discussion in Section D of this report, drawing on new school datasets, shows that using school poverty quintiles produces almost the same results as using household and asset-based quintile distributions, although that analysis relates to a somewhat different aspect.

personnel costs were relatively small, overall conclusions regarding spending incidence were not seriously adversely affected as a consequence of the lack of data on this budget item.

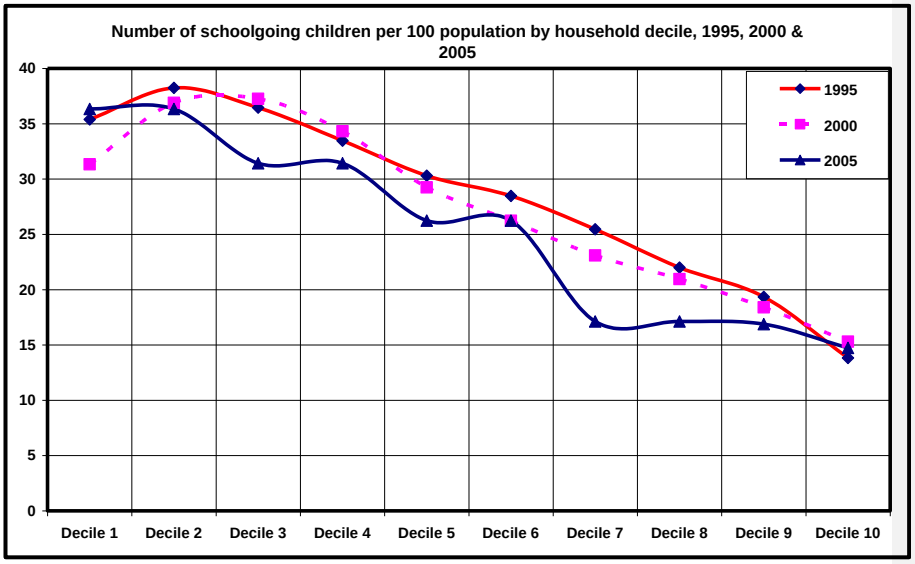
As this analysis was not aimed at considering the impact of social grants as well, as had been the case with other incidence analyses, household did not have to be ranked by income before social transfers, but simply by income or, in its absence, by assets. This was done using the General Household Survey (GHS2005) to obtain a welfare ranking for generating household quantiles. Two options were considered, the first of which involved extracting wealth quantiles by applying PCA to asset indicators contained in the dataset. However, results from this procedure did not fit the pattern of distribution of children across household quantiles found in previous surveys. Therefore the second option was chosen, namely using the broad *household* expenditure categories from GHS2005, converting these to *per capita* expenditure, and then deriving household deciles. The expenditure brackets in which expenditure was captured in the GHS are quite broad, and there were thus concerns that a single question on expenditure may not deliver very accurate expenditure data. However, the pattern of distribution of children across the GHS household expenditure quintiles more closely matched that obtained from IES2000 than those obtained using PCA, so this method was selected as the preferred one.

To deal with uncertainties regarding the accuracy of this method, and particularly the pattern of population distribution, sensitivity testing was undertaken, including testing for the effect of changes in population structure rather than of spending patterns on the concentration index.

It is also important to bear in mind that the analyses for 1995 and 2000 were carried out using pre-transfer income deciles, as the intention in these studies was to determine the *overall* incidence of *all* social spending, including social transfers. The value of these transfers was thus first subtracted from income before households were ranked by pre-transfer income. This possibility is not available for the GHS2005 dataset, and the intention here was not to measure the impact of all social spending, so post-grant income was considered more appropriate as welfare ranking. Figure 1 shows the population structure across household deciles as derived from the different data sets and methodologies for 1995, 2000 and 2005. The figure reflects the

number of children at school per 100 population in each decile. There is a fair degree of similarity in slopes between the different years, despite differences in the sources of the data. This generates some confidence in the results obtained in this study. Although the data for 2005 reflect lower proportions of school-going children across almost all deciles, which must have been the result of a statistical aberration, the effect was not so large that it caused large shifts in aggregate spending estimates across deciles. The concentration indices presented later also show a relatively minor impact of the population structure on the results.

Figure 1:



INCIDENCE OF SCHOOL SPENDING, 2005

The results show that the shifts in spending towards the poorer parts of the household income distribution had continued beyond, even though they had moderated considerably.

Data on salaries per teacher, weighted by the number of children of each race group taught by them, showed considerable consistency between 2000 and 2005. This fitted expectations and

confirmed that the fiscal data sources were compatible. The exception appeared to relate to the salaries of coloured teachers, where the large relative change vis-à-vis white teacher pay between 2000 and 2005 was a little suspect. However, this did not much affect overall results. Moreover, it should be considered that the 2005 data were based on only a sample of schools for which race and salary data were available; apart from some concerns relating to apparently erroneous salary data, the loss of data for some schools was expected to have indeterminate results on the salary ratios. The major conclusion from Table 3 was that there was still an advantage of just over 27% per child in teacher costs accruing to white students in relation to black students, largely driven by the generally more highly educated teachers teaching in historically white schools, where white children were still concentrated. As was shown earlier in Table 1, taken from the work of Gustafsson and Patel (2006), spending per child of each school quintile still showed an advantage for the top quintile of approximately 11%. If the non-teacher personnel spending was ignored (or – more appropriately – distributed across quintiles in the same proportion as teacher costs, since information on the distribution of such spending was not available in 2000), the advantage reduced somewhat.

Table 3: Annual cost per teacher, weighted by race of students, from a sample of schools, 2005

	Black students	**Coloured students**	**Indian students**	**White students**	**Total for students of all groups***
Quintile 1	R 103 843	R 120 982	R 123 539	R 130 063	R 102 732
Quintile 2	R 105 608	R 125 866	R 128 979	R 144 552	R 105 110
Quintile 3	R 110 355	R 129 192	R 125 514	R 118 840	R 109 524
Quintile 4	R 114 287	R 129 062	R 133 551	R 139 024	R 117 444
Quintile 5	R 118 150	R 135 522	R 134 165	R 139 812	R 128 271
Total for all quintiles	R 108 620	R 130 406	R 133 180	R 138 461	R 111 344
Ratio for all quintiles 2005	100%	120.1%	122.6%	127.5%	
Ratio in 2000	100%	110.7%	119.2%	126.7%	
Students by race 2005	9 817 488	873 087	200 853	608 891	11 562 298

* Note that a small number (61979) of "other" students are not included in the race data. Moreover, not all schools gave accurate or complete data on the racial composition of enrolment, thus the estimates for 2005 presented here may be affected in indeterminate ways.
Source: Calculations based on PERSAL and EMIS data

Whereas the ratio of allocations in accordance with the Norms and Standards funding should have been 175:125:100:75:25 between the different quintiles (all expressed relative to the middle quintile's allocation), the actual allocation estimated from national EMIS data was 162:128:100:78:44. It thus appears as if the top quintile was getting somewhat more than the share it should have been allocated by the Norms and Standards, and the bottom quintile slightly less. However, this was more than compensated for by two factors: firstly, the rest of recurrent expenditure (the so-called "top-slice") was also allocated in a fashion that favoured the poor, as Table 4 shows (based on the assumption by Gustafsson and Patel (2006) that it is half as well targeted as the Norms and Standards spending). Furthermore, the proportion allocated by the Norms and Standards procedure and that under the top slice were virtually equal in 2005, unlike the one-third share assumed for the former for 2000. Consequently, total recurrent spending favoured the poorest quintile considerably: students in this quintile received almost twice as much recurrent spending from provincial government as those in the richest quintile did.

Table 4: Relative allocations of recurrent spending per student by school quintile, 2005 (relative to school quintile 3)

	Quintile 1	**Quintile 2**	**Quintile 3**	**Quintile 4**	**Quintile 5**
Norms and Standards target	175	125	100	75	25
Actual provincial Norms and Standards allocations 2005	162	128	100	78	44
Top-sliced: Assumed	117	110	100	106	84
All recurrent 2005	132	113	100	87	61
2000 Assuming 1/3 followed Norms & Standards ratio, the rest equally*	125	108	100	92	75

* Strictly speaking the data are for school quintiles, but because of the small amounts involved, the 2000 school quintile data were also used at the household quintile level.
Source: Calculations based on PERSAL and EMIS data

Translating these figures into the racial categories and household deciles allows comparison with the data from 2000 and for 1995. In 1995 the white advantage in spending per student was 140% above the level accruing to black students. This advantage was reduced to 24% in 2000, but hardly declined further, remaining at 22% in 2005. However, the 2005 data included non-teacher pay, which was not included in 2000 and which was still quite inequitably distributed. Once this expenditure item was excluded, and all personnel spending assumed to be spent as on teachers (as was assumed for 2000), then there appeared to have been a further reduction of perhaps three percentage points. This can be better seen in the ratio of the spending per student in Decile 10 of households, versus that in the bottom quintile of households: this ratio dropped from 224% in 1995, to 118% in 2000, and to 111% in 2005. If one excludes the impact of data available only for 2005 on non-teacher personnel costs, the 2005 figures falls further to 108%. One can conclude that the improvement in targeting was continuing, although its pace had moderated. It is also noticeable that the reduction in the ratio of spending per student in Decile 10 to Quintile 1 was more rapid and ended at lower levels than the decline in the white/black ratio. This could well reflect inaccuracy in measuring per capita student spending by race, given that EMIS race data were of dubious quality. It seems unlikely that white students were benefiting from public spending levels substantially exceeding those accruing to other members of Household Decile 10, or far above those received by members of School Quintile 5.

Table 5: Spending ratios per student

	Coloured: Black	**Indian: Black**	**Whites: Blacks**	**Decile 10: Quintile 1**
1995	102%	196%	240%	224%
2000	103%	121%	124%	118%
2005	112%	120%	122%	111%
2005: Excluding non-teacher personnel costs				108%

In overall terms, what these calculations therefore showed is that not much changed in terms of the allocation of school spending between household deciles in the period since 2000, in line

with an earlier prognosis by Van der Berg (2003) that further shifts in spending across income or race groups are likely to be minor, given that most of the massive differentials from the apartheid era had already been eliminated by 2000. The trend towards favouring poorer schools through the Norms and Standard spending – and also more recently through post-provisioning – means that some further redistribution to the poor can be expected, although this would still be modest. The likelihood is increased when one considers the part of the data not included in 2000, namely non-teacher personnel spending, which – though of small magnitude – highly favoured more affluent schools.

Gustafsson and Patel (2006: 72) stated that the position with regard to non-teacher personnel costs was largely a consequence of the fact that post-1994 national policy interventions were not much concerned with non-teacher personnel spending. They pointed out that unions representing non-teacher personnel were opposed to the redistribution of such positions due to concerns about redeployment to poorer schools, often in rural areas. Gustafsson and Patel therefore argued that it was necessary for greater equity in the school system that additional posts be created for non-teacher personnel in poorer schools. Gauteng appears to be an exception in this regard as such posts were redistributed across the quintiles in this province without major dislocations.

The spending patterns across household deciles in 1995, 2000 and 2005, as presented in the concentration curves in Figure 2, show a major shift between 1995 and 2000, with a much smaller subsequent shift between 2000 and 2005. In order to draw valid comparisons, it is necessary to exclude the impact of the non-teacher personnel costs from 2005, as these data were not available for previous datasets. Excluding this effect slightly improves targeting, although the difference is not really visible on the concentration curves and can be better seen in Figure 3. This shows the vertical distance from the diagonal of the concentration curves on the vertical axis, and the larger scale allows a better comparison. Including non-teacher personnel implies a slightly worse estimate of the targeting of spending to poorer household deciles than when this spending was excluded.

Table 6 shows the concentration indices for each of the four curves shown earlier, as well as those for the school-going population in the three years considered. Complete equality of spending would imply that the concentration curve for the school-going population would coincide with that for education spending. This objective has clearly not yet been reached. To investigate how far South Africa currently falls short of attaining it, the difference between the actual concentration curve and the curve for the school population in each of the years considered is also shown. As can be seen, at 0.019 this difference is now quite small compared to its value of 0.107 in 1995; it is even smaller at 0.012 when the 2005 data are used without considering the effect of non-teacher personnel spending, which is the appropriate comparison to use for this purpose. However, as can be seen from the other 2005 value, there is a little further to go still, as has also been pointed out by Gustafsson and Patel (2006).

Figure 2: Concentration curves for school spending, 1995, 2000 and 2005

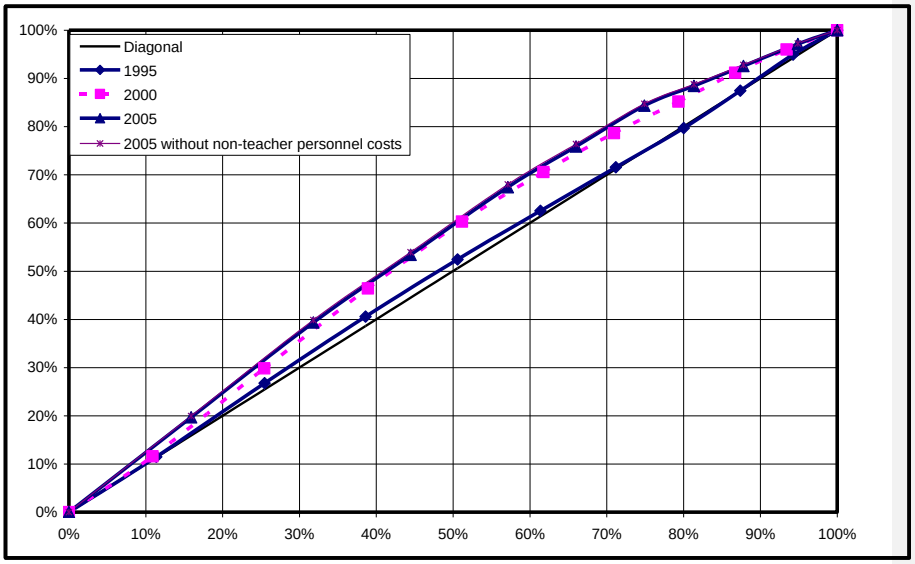


Figure 3: Concentration curves for school spending, 1995, 2000 and 2005: Vertical distance from diagonal

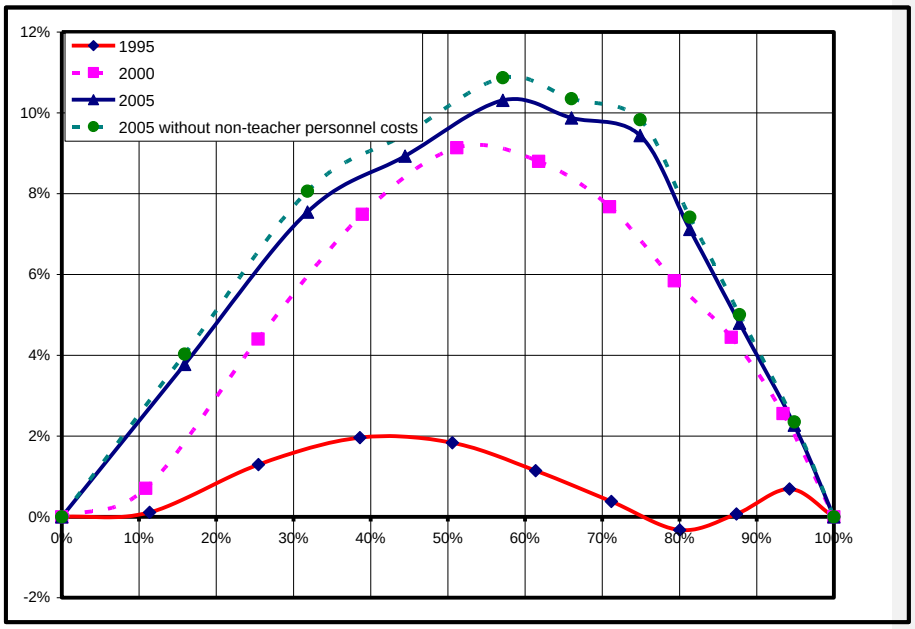


Table 6: Concentration index for spending and difference compared to concentration index and for school-going population

	Concen-tration index	**Concen-tration index for school-going population**	**Difference**
1995	-0.016	-0.124	0.107
2000	-0.104	-0.121	0.017
2005	-0.129	-0.147	0.019
2005 (excluding non-teacher personnel costs)	-0.136	-0.147	0.012

Figure 4:

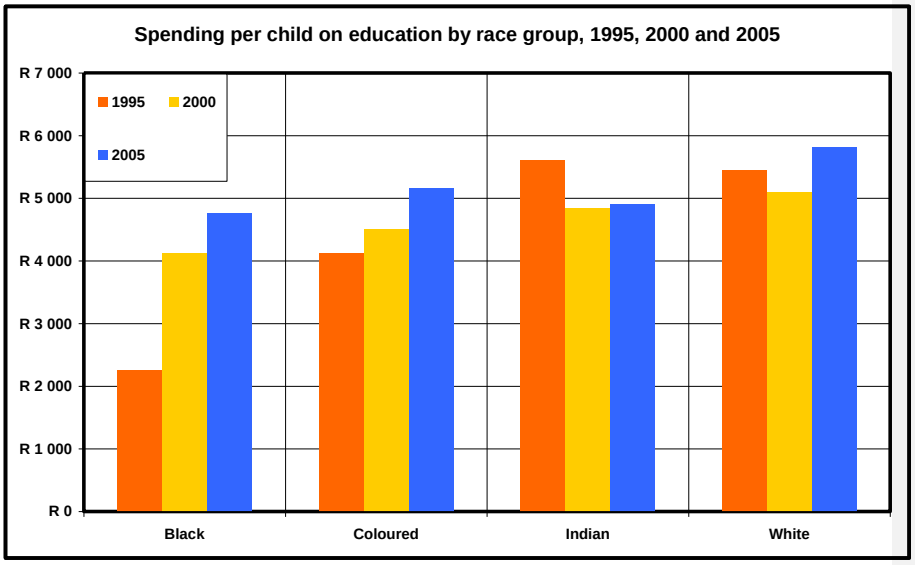


Table 7: Adjusted cost per student by household quintile/decile, 2005 (Rand per student)

	Household groupings						
	Q1	Q2	Q3	Q4	D9	D10	Total
Teacher pay	3983	4073	4175	4306	4404	4386	4103
Non-teacher pay	130	188	250	318	364	353	202
Norms & Standards	349	275	219	168	135	154	273
Top-slice	209	306	326	330	328	294	276
Total	4743	4816	4918	5056	5159	5149	4854

Source: Calculations based on PERSAL, EMIS, GHS and TIMSS data

Conclusion on spending incidence

This section has extended the analysis in earlier studies of expenditure incidence in public education spending across the household income distribution. From this analysis it is clear that the trend towards improved expenditure equity had continued beyond 2000, although at a much slower pace now that most of the very large apartheid-era differentials had been eliminated. There was some scope for further redistribution to further enhance equity, but this scope had been diminishing. The issue at the top of the list was spending on non-teacher personnel.

SECTION B: BEYOND EXPENDITURE: BENEFIT INCIDENCE ANALYSIS

EXTENDING THE ANALYSIS: DECOMPOSITION ANALYSIS APPLIED TO EDUCATION DATA TO DETERMINE HOW MUCH RICH AND POOR BENEFIT FROM THE EDUCATION SYSTEM

One of the criticisms raised against traditional fiscal incidence analysis is the underlying assumption that the benefit derived from a public service (by individuals receiving the service) is equal to the cost of providing that service (Van de Walle, 1996). However, this assumption is often unrealistic in that it does not consider whether the underlying system of public service provision converts the spending into measurable outcomes (increases in the welfare of individuals) equally across the income distribution. More specifically, it is possible to envisage a system where, because of inefficiencies, public spending (although equally distributed across poverty quintiles) favours the non-poor more than the poor because the non-poor part of the system has the capacity to convert the public spending into welfare-enhancing outcomes more efficiently. Therefore, in order to conduct a more realistic analysis of the benefit of the service for different groups within the population, a measurable outcome (accruing as a benefit) which is directly assignable to the public spending, should be used.

Given the inequalities in the education system in South Africa, a public incidence analysis of the spending on schools within each of the poverty quintiles may provide a limited view of the benefit that is actually being derived by the learners within these schools. In order to obtain a clearer view of exactly what the size of these benefits are, it is necessary to consider the way in which schools in each of the poverty quintiles convert public spending into improvements in test scores of learners, rather than only considering the amount spent on schools in each quintile.

Section A has shown that the massive differentials in fiscal resource allocation that were characteristics of apartheid have largely been eliminated, and that fiscal incidence is now

marginally favouring poor households, though on average the public spending to fund the schooling of a poor child is still slightly less than that which funds a child in a more advantaged school. It will later be shown in Section D, which discusses social gradients, i.e. inequality across the socio-economic spectrum, that some other differentials between poor and rich schools that remain large. Also, the same applies to the lasting effect of past resource allocation on infrastructure differentials between schools. However, Section D will especially consider the inequality in cognitive outcomes that remain so much part of the school system.

The remaing fiscal resource differences discussed in Section A are almost negligible, thus they cannot explain the large differences in cognitive outcomes between schools serving rich and poor students. Two possible explanations can be put forward in the South African context. The first is that home background, often captured by SES as a proxy for home circumstances, parent education, and the "home subsidy" that middle class children benefit from, is a major factor affecting educational achievement. A second factor is that schools serving the poor are, in South Africa at least, generally less efficient than those serving the more affluent.

This section attempts to get some estimate of the extent to which the benefits accruing to poor and to rich children from education are different, because of the fact that the schools attended by the poor generally provide education of an inferior quality, irrespective of the fact that they have similar public resource inputs. The aim is to determine whether differences in the efficiency of the use of school resources drive gaps in student performance and thus perpetuate socioeconomic inequalities.

Oaxaca-Blinder method

A first approach to measuring such efficiency differentials, and thus the distribution of the benefits of educational spending, is to use Blinder-Oaxaca decomposition techniques, more commonly applied to measure labour market discrimination. This is employed here on TIMSS2003 Grade 8 Maths test score data. Firstly, however, a table presenting a range of data by student affluence quantile is presented.

Table 8: Selected population, student and school statistics, 2005

	Quintile 1	**Quintile 2**	**Quintile 3**	**Quintile 4**	**Decile 9**	**Decile 10**	**All / Average**
Households, 2005	2 594 479	3 018 607	2 042 916	2 539 104	1 203 469	1 048 877	12 447 452
Share of households, 2005 (%)	21	24	16	20	10	8	100
Population, 2005	14 625 557	11 635 405	8 171 877	5 922 007	3 261 402	2 355 023	45 971 271
Share of population, 2005 (%)	32	25	18	13	7	5	100
Grade 8 students, 2005	434 053	340 766	205 384	95 996	59 203	32 254	1 167 656
Share of grade 8 students, 2005 (%)	37	29	18	8	5	3	100
All school students, 2005	5 314 024	3 656 301	2 144 863	1 014 446	550 803	346 870	13 027 307
Share of all school pupils, 2005 (%)	41	28	16	8	4	3	100
Public spending per student, 2005	R 4 743	R 4 816	R 4 918	R 5 056	R 5 159	R 5 149	R 4 854
Public spending per capita (whole population), 2005	R 1 697	R 1 522	R 1 304	R 877	R 884	R 764	R 1 372
TIMSS Grade 8 Maths score, 2003	223	251	286	345	431	521	264
Measure of efficiency	47.0	52.1	58.2	68.2	83.5	101.2	54.4

The expenditure advantage that more affluent children still enjoy is evident, as discussed in Section A, although this disappears when *per capita* rather than *per student* spending estimates are used. Apparent however is the substantial disparity between mean test scores obtained by students in the poorest quintiles of the Grade 8 population – largely those attending historically black schools – and the scores obtained by students in the wealthiest household decile, who attend predominantly historically white schools. The issue of interest is whether this achievement gap is due to the greater home background advantage of wealthier students, or to the better resourced schools which they attend.

School performance is infludnced both by the availability of resources and the efficiency with which these resources are managed. While more affluent schools are able to draw on a greater stock of resources, it appears that in the South African case they are also more efficient at

converting these resources into student outputs. The measure of efficiency – computed as TIMSS Maths score divided by cost per student multiplied by 1000 – is low and varies little amongst the poorest three student quintiles. By contrast, efficiency grows exponentially for the 9th and 10th deciles. This accords with earlier research on the 2001 SACMEQ dataset, which found that there was very little relationship between socioeconomic status (SES) and student performance for the poorest 60% of students, rising sharply and positively thereafter (Van der Berg & Louw 2006). However, it should be borne in mind that this measure of efficiency was likely to be overstated for students in the top two household deciles, since only public resource contributions towards schooling were taken into account here, and private contributions (school fees, fundraising and so on) were much larger for these students.

Turning to more formal analysis, the Blinder-Oaxaca decomposition separates the gap in achievement between students in affluent schools (defined as the 20% of schools which have the highest average student asset index scores) and the remainder into three main components through analysing each group separately and comparing regressions run on each. These three components reflect the portions of the "achievement gap" that can be attributed to differing endowments across the two groups, to varying coefficients from the separate regressions estimated for the two groups, and to differences across the two groups' regression intercept terms. To obtain the Blinder-Oaxaca decomposition, the TIMSS Grade 8 Maths test score was regressed on three measures of SES (an index reflecting mother's level of education, an index reflecting father's level of education and a household asset index), three dummies indicating the amount of time a student spent on homework – proxying for the student inputs of ability and effort –, and a dummy variable indicating whether the student's Maths teacher had a degree, thus reflecting the impact of school resources on Maths achievement. The most affluent 20% of schools are defined as the reference group for purposes of the decomposition.

The results from the Blinder-Oaxaca decomposition are presented in Table 9. Observe firstly that differences in endowments, mainly related to SES, account for just more than half of the gap in achievement between relatively affluent schools and the rest. Insofar as the differences in

endowments related to school resources (qualifications of Maths teachers, in this case) still play some role (though it contributes less than 10% to overall variance), it reflects differences in private and public resources operating to the advantage of the more affluent children that attend affluent schools, which implies that historical patterns of privilege continue to be perpetuated. Differences between coefficients appear to contribute very little to the achievement gap, accounting for approximately 4% of it. The remainder is due to the difference between regression intercepts for the two groups (294 versus 232), which implies that children attending more affluent schools achieve at a higher level before differences in private and public resources are considered. This may be reflecting the higher efficiency of conversion of inputs into outputs in more affluent schools, noted above.

Table 9: Oaxaca-Blinder decomposition results for variables (variance explained):

Variable	**Attributable**	**Endowments**	**Coefficients**
Mother's education	565.0	385.3	179.7
Father's education	1034.8	538.1	496.7
Household asset index	5600.6	6573.0	-972.3
Maths teacher has degree (1=yes)	1876.3	864.2	1012.0
15-30 minutes Maths homework (1=yes)	260.4	98.4	162.0
31-60 minutes Maths homework (1=yes)	-24.7	48.6	-73.3
61+ minutes Maths homework (1=yes)	-157.0	2.1	-159.1
Subtotal	**9155.5**	**8509.7**	**645.8**

Summary of decomposition results (as %)

Amount attributable:	9155.5
- to endowments (E):	8509.7
- to coefficients (C):	645.8
Shift coefficient (U):	6236.7
Raw differential (R) {E+C+U}:	15392.2
Adjusted differential (D) {C+U}:	6882.5

Note: Positive number indicates advantage to high group, negative number indicates advantage to low group

Taking the analysis down one level of aggregation, the relative contributions of private and school resources can be evaluated. The three measures of student SES jointly explain 79% of the attributable portion of the achievement gap between affluent and other schools that the Blinder-

Oaxaca decomposition can explain (that is, excluding differences due to varying intercept terms). Given the weak availability of school resource measures in TIMSS, only one variable – whether the teacher has a degree – is used to capture the impact of varying school resources on student achievement. In total, this school resource contributes an estimated 20% of the attributable portion of the achievement gap. More than half of this effect (54%) operates through the coefficient, in other words, as a result of differences in the efficiency with which degreed Maths teachers are used, while the remainder is due to rich schools being better endowed with degreed Maths teachers.

Thus this tentative extension of the fiscal incidence work into a Oaxaca-Blinder decomposition of the factors that drive differential performance between richer and poorer schools shows that a very large part is based on the advantages that come with higher socio-economic status. This may, however, to some extent also be a reflection of varying efficiency of spending in more affluent schools. Resource differences play a smaller role, as do the efficiency of these resources in this decomposition. Unfortunately, the TIMSS dataset may not be the best to use for this purpose, as there are few resource variables and one can therefore not conduct a more thorough investigation of the role of resources and their application in determining school outcomes. Also, it would be best to undertake such an analysis not on cross-section data, but on value added data.

Alternative decomposition methods

This section sets out to obtain a clearer view of the benefits from the public spending within each poverty quintile, by attempting to identify the average efficiency of the schools within each of the poverty quintiles in transforming public spending into test scores.

Multivariate regressions on the test scores and test score gains

As a starting point, multivariate regressions are used to estimate the conditional mean numeracy score of schools within each of the official poverty quintiles. For this purpose, data are used from the National School Effectiveness Study (NSES), collected from a nationally representative

sample of schools in South Africa, including 266 schools in eight of the nine provinces.[2] The dataset contains data on a cohort of learners in grade 3 (2007), grade 4 (2008) and grade 5 (2009). The same children were tested in each of the years in numeracy and literacy, using the same test, in order to make the results comparable across years. The dataset also contains detailed data on the school, learner and household characteristics.

First an ordinary least squares regression is run of the numeracy test scores of learners in 2009 on a number of control variables (controlling for learner and household characteristics as well as for the province in which the school is situated). An indicator variable for each of the poverty quintiles is also created, so as to get some idea of the size of the difference in the numeracy scores between the five quintiles, after controlling for the above-mentioned variables. Table 10 below contains the results for this regression.

In terms of gauging the benefit of public spending on each of the poverty quintiles, an initial indication of the way in which the schools in each of the quintiles transform the spending into results may be inferred from the regression results. While no statistically significant difference is observed between the first, second and third quintiles, the difference in the mean conditional numeracy score between the first and fourth, and first and fifth quintiles is statistically significant. According to the regression outcomes, there is a difference of almost 4 points[3] between the first quintile schools and the fourth quintile schools on average, after controlling for the individual learner and household characteristics. The corresponding difference between the first and fifth quintile schools is almost 11 points. This provides some indication of the size of the difference in the mean test scores between the quintiles.

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[2] Gauteng was not included in the study as a result of other testing being administered in the province at the time of enumeration.

[3] The numeracy test score is out of 100.

However, one could argue that, in order to ascertain the benefit to learners as a result of the public spending on the schools in each of the quintiles, it would be more accurate to take the difference between the scores for each child in 2009 and 2007, in other words, the *gains* in the test scores. This would give some indication of the way in which schools within the quintiles were able to convert public funds into improvements in test scores and would take into account the fact that lower quintile schools start from a lower base. By taking the gains in the scores, one is measuring the learning that takes place within each of the poverty quintiles on average; this may be a much better indication of the benefit derived by learners in each of the poverty quintiles as a result of the spending on education within the quintiles. The results from this regression are also reported in Table 10 below. The coefficients for the variables for the poverty quintiles are not statistically significant, except for quintile 4 which is marginally significant at the 10% level. When one looks at the gain in the numeracy score between these three years, the fifth quintile falls away and no difference between the first and fifth quintile can be discerned.

Table 10: Multivariate regression of numeracy scores in 2009 and the gain in numeracy scores from 2007 to 2009

	Numeracy Score 2009		**Gain in Numeracy Score from 2007 to 2009**	
	Coefficient	**Standard Error**	**Coefficient**	**Standard Error**
Learner SES	2.31***	0.61	-0.13	0.54
Learner SES squared	1.44***	0.42	-1.19**	0.46
Female	-0.19	0.54	-0.44	0.54
Age in years	-2.75***	0.37	-2.26***	0.39
Household size with > 4 siblings	-2.31***	0.59	0.91	0.58
Read alone 1 to 3 times a week	3.57***	0.83	-0.33	0.97
Read alone 4 times or more a week	6.19***	1.15	-0.83	1.17
Read with an adult 1 to 3 times a week	-3.58***	0.76	-0.47	0.69
Read with an adult 4 times or more a week	-7.22***	1.01	-2.18*	0.95
Home language is English	10.31***	3.17	1.46	2.67

	Numeracy Score 2009		Gain in Numeracy Score from 2007 to 2009	
	Coefficient	**Standard Error**	**Coefficient**	**Standard Error**
Speak English at home 1 to 3 times a week	2.43***	0.70	1.99**	0.79
Speak English at home 4 times or more a week	2.44*	1.43	1.40	1.13
Watch Television 1 to 3 times a week	0.61	0.75	-0.47	0.89
Watch Television 4 times or more a week	5.90***	0.84	2.43**	1.03
Do homework 1 to 3 times a week	5.39**	1.68	3.53*	1.65
Do homework 4 times or more a week	7.90***	1.75	3.68*	1.78
1 to 10 books at home	2.18**	0.72	2.12	1.14
10 to 50 books at home	2.39**	0.95	1.62	1.21
More than 50 books at home	2.95*	1.37	-1.75	1.46
Poverty Quintile 2	0.38	1.81	1.22	2.14
Poverty Quintile 3	1.84	1.79	-1.56	2.26
Poverty Quintile 4	3.89*	2.31	4.46*	2.61
Poverty Quintile 5	10.75**	4.41	-2.26	3.49
Constant	46.61***	3.50	21.94***	3.67
N	8247		8247	
R squared	0.31		0.08	

Notes: Sample includes only children appearing in all three waves (i.e. 2007, 2008 & 2009).
Coefficients for provincial dummies not shown
Standard errors clustered at the school level.
* Significant at 10% level
** Significant at 5% level
*** Significant at 1% level

One possible explanation for this result is the fact that children in quintile 5 already performed much better than children in quintile 1 schools on average in 2007 and thus recorded much smaller gains. The fact that quintile 5 schools have less to gain from their initial score in 2007 indicates the need for alternative methods to capture the efficiency of schools within each of the quintiles in transforming public spending into measureable improvements for learners. The rest of this section will discuss two possible methods with which this can be achieved.

Method One: Lemieux Decompositions

As set out above, the essence of a benefit incidence analysis is to capture the efficiency level of schools within each of the 5 quintiles in transforming public spending into test scores. This can be seen as the benefit accruing to learners in schools within each of the quintiles, against which the public spending on each quintile can be compared. One method with which to do this is by decomposing the factors explaining the mean performance of the schools within each quintile (i.e. the mean numeracy scores per quintile) into those related to the characteristics of the learners within the schools on the one hand, and those related to the ability of the school to operate efficiently, on the other hand. This is firstly done by using a technique developed by Lemieux (2002) to decompose the changes in the numeracy test scores from 2007 to 2009 into those related to changes in learner and household level variables (in other words, the "x"s or variables included in the regression) and those related to the efficiency of the school system within each quintile to effectively convert resources into learner performance (in other words, the coefficients for each of the variables). This involves running an out-of-sample regression of the coefficients for the years 2008 and 2009, using the 2007 sample characteristics for each of the poverty quintiles.

Using 2007 characteristics ensures that the changes in the test scores across the years are attributable only to changes in the coefficients across the years, i.e. how efficiently the schools in each of the poverty quintiles have been able to transform endowments (i.e. learner characteristics) into test scores, using the public funds allocated to them. This should give one a better idea of the learning occurring from 2007 to 2009 which could be attributable to school efficiency within each quintile.

The results across all five quintiles show, surprisingly, that quintile 4 schools generate even more learning than quintile 5 schools. The reason for this is easy to detect, however: Many learners in quintile 5 schools were already performing close to the maximum on the test in Grade 3, and the same test was again used in Grade 4 and 5, so there was little scope for them to improve further: They simply experience a ceiling effect.

One way in which to deal with this ceiling is to take only the difficult questions in the tests so as to make it possible even for most learners who initially performed quite well to also show substantial improvement on their scores. A new score for the numeracy test in NSES was generated considering only 25 of the 53 questions, namely those where less than 50% of the learners in fifth quintile schools provided the correct answer in their first attempt in the 2007 test, decreasing the mean score for quintile 5 schools to 36.68% (instead of 50.28%) in 2007 and therefore allowing ample room for improvement for schools in poverty quintile 5.

Furthermore, the top two quintiles were classified together and the same was done with the bottom three quintiles, thus leaving only two groups of schools to compare. This seems to be a natural way in which to deal with the bimodal nature of the South African system, with quintile 4 and 5 schools outperforming schools in the bottom three quintiles. The Lemieux Decomposition technique is used to calculate the gain in the scores of schools within each of the poverty quintiles. From this it became apparent that much more learning was taking place in the richer schools. The benefits in terms of learning they were obtaining from school were simply much larger than was the case for schools in the bottom three quintiles, as Table 11 indicates. The gain in test scores over the two years was 22.7% in the top two quintiles, as against only 12.8% in the bottom three quintiles. Effectively, this means that the children in more affluent schools are benefiting more in terms of learning outcomes from being at school, despite the fact that they obtain similar fiscal resources from the state. Consequently, as the more affluent children are obtaining greater learning benefits, learning outcomes are diverging further with progression to higher grades.

Table 11: Mean Numeracy Test Score Gain for quintiles 1 to 3 and quintiles 4 and 5 using the Lemieux Decomposition for 2007 to 2009 - only difficult questions

	Numeracy Test Score Gain (Lemieux Decomposition) 2007 to 2009 Only difficult questions	
	Coefficient	**Standard Error**
Poverty Quintile 1, 2 and 3	12.83***	1.22
Poverty Quintile 4 and 5	22.70***	2.13
N	7918	

R squared	0.83

Notes: Sample includes only children appearing in all three waves (i.e. 2007, 2008 and 2009).
Standard errors clustered at the school level.
* Significant at 10% level
** Significant at 5% level
*** Significant at 1% level

A final alternative for taking into account the limited gain available to quintile 5 schools is to group quintile 1, 2 and 3 schools together on the one hand and quintile 4 and 5 schools on the other.

Percentage gain

A second method possible to provide for the limited opportunity of strong initial performers to improve on their initial score is by using the gain of each learner as a percentage of the possible gain that he/she could have made, given his/her initial test score. For example, if a specific learner scores 20 out of 100 in the initial test in 2007, that learner has a potential gain score of 80 points. Should the learner end up scoring 50 out of 100 in the final test in 2009, the learner's relative percentage gain would be (50-20)/80 = 0.375, in other words 37.5%. This methodology was applied in regression analysis, but did not yield clear answers as to the different benefits that learners obtained in different school quintiles.

Conclusion

Expenditure equity does not mean benefit equity: the more affluent population still receives by far better education. If expenditure is converted to the outcomes it buys, it turns out that the most affluent decile gains twice as many TIMSS points per R1000 spent per students. Clearly, efficiency gains can bring far greater rewards for those lower down the distribution than further shifts of resources are likely to buy.

This section set out to identify the benefits accruing to learners within schools in each of the 5 poverty quintiles, using a number of approaches, including the Oaxaca-Blinder decomposition method and the decomposition technique developed by Lemieux (2002), to gauge the improvement in test scores from 2007 to 2009 within each quintile as a result of the way in

which schools within the quintiles are able to transform “endowments” (i.e. learner characteristics) into outcomes (i.e. test scores) using the public funds available to the school.

Both of these methods applied to the NSES data indicate that schools in the top quintile, or in the top two quintiles, are much more efficient in transforming public funds into higher test scores than schools in lower quintiles.

SECTION C: PRIVATE SPENDING ON EDUCATION AND EQUITY

Introduction

Another form of inequity that needs to be investigated relates to private spending on education. Since the Hunter Report there has been emphasis on school fees as a way for schools to supplement resources from parental contributions through school fees. In the past few years such school fees have been abolished for schools in the poorest three quintiles of the distribution. This reduces the importance of school fees as a potential barrier to school attendance, but also ensures that the poor would not face a substantial economic burden to educate their children.

Education spending data from the HSRC Survey of 2004

Some household surveys, such as the 2006 Income and Expenditure Survey conducted by Statistics South Africa, do contain expenditure data on education at the household level. However, such data are not greatly disaggregated, do not draw a distinction between different forms of education (e.g. tertiary education spending is not separated from spending for school children), and are not aimed specifically at investigating expenditure on education. Margins of error on such data are thus large.

For this reason the then Department of Education requested that the data Human Sciences Research Council include a number of questions on education in a dedicated household survey undertaken in 2004 to obtain information on a number of areas of service delivery. This dataset was analysed as part of this study, and its results are used in the analysis that follows.

No weights are provided in the dataset, so it is not possible to weight the results up to the national level. It is assumed that the HSRC took care to ensure that the population sampled is broadly representative, though the black proportion of the total population is lower than is the

case amongst the `population as a whole, even considering those whose race is unknown. Households were divided into quintiles, but these are quintiles are quintiles of household income and thus not the same as school quintiles. Although these quintiles and school quintiles should thus not be confused, the household quintiles offer a perspective of how expenditure is distributed across the household income distribution. Expenditures per child at school at the primary and at the secondary level are captured for all expenditure items. The racial composition of quintiles shows that the poorest quintiles are dominantly black, while the top quintile is much more racially mixed.

School fees:

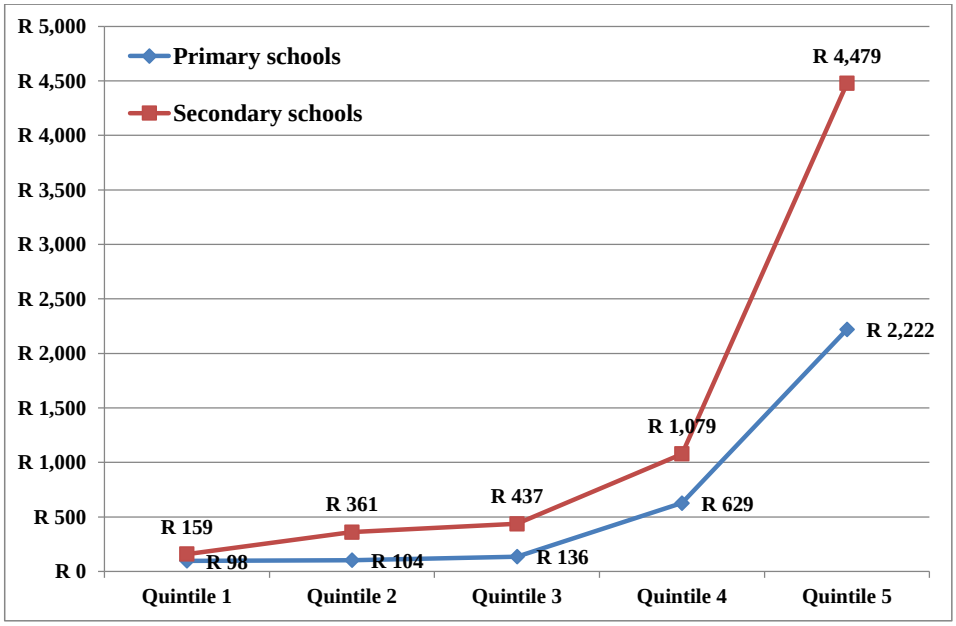
It should be noted that this survey was undertaken a number of years ago. This has an effect not only on the costs, which should be adjusted for inflation, but also on some of the institutional details. Regarding inflation, the Consumper Price Index in 2012 is 60% higher than at the time of the survey. On the institutional factors, at the time of the survey, the no fee policy had not yet been instituted, so in principle all children were in fee-charging schools, although a large proportion were fully or partly exempted from paying such fees on grounds of poverty, and many parents in practice simply did not pay it.

Figure 5 shows average school fees for primary and secondary school by household expenditure quintile. Note that the level of school fees is generally quite low, particularly in primary schools, even if one considers the effect of inflation. Even in secondary schools, the third household quintile only paid an average of R437 per annum in school fees. Allowing for inflation, that is just over R700 per year in today's purchasing power. That placed some burden on the household, but not too great a burden if one considers that such children generally qualified for a child benefit of more than four times this amount. In primary schools, the school fees were even much lower. The benefit of the no fee school policy introduced in recent years (first for the bottom two quintiles of schools, now expanded to the third quintile) was thus only moderate for some parents whose children were in secondary schools, and in primary schools this benefit was quite small.

Total spending per learner is much higher in the top quintile, both in primary and secondary schools. Interesting, it does not seem as if the cost rises much between primary and secondary, although there appears to be much more variation in spending levels amongst the poorer quintiles in secondary school. While actual school fees were quite low in the bottom three quintiles (on average below R140 per year in primary school and below R262 in secondary schools), the average rose considerably in quintiles 4 and especially 5. The share of fees in total cost was accordingly also much higher in quintile 5 at about 36% of total education spending by households in both primary and secondary schools, while in the bottom quintiles fees made up less than 20% of total spending. Thus the fact that schools fees have now been abolished in the poorer schools brings only limited relief to poor households, amongst whom other expenditure items were more dominant. Chief amongst these was school uniforms (constituting almost half of the cost of primary education for the poorest quintile of households) and food. School uniforms have a quite regressive effect, with the poor paying the largest share of their school spending on this item.

In contrast to the poorer quintiles, some of the school fees in the higher quintiles, particularly in secondary school, are more substantial. There is an argument that more of the benefits of education at higher levels accrue to the individual and that the external benefits are less at higher levels, but this is not really applied to school education in an international context: It is more often used as argument why tertiary education should/could have a large self-financed component. However, here a user fee argument could also be applied: To the extent that parents who are not exempt from fees because if low incomes send their children to more expensive school, it is a user fee in that the resources so raised supplement the public resources in the school.

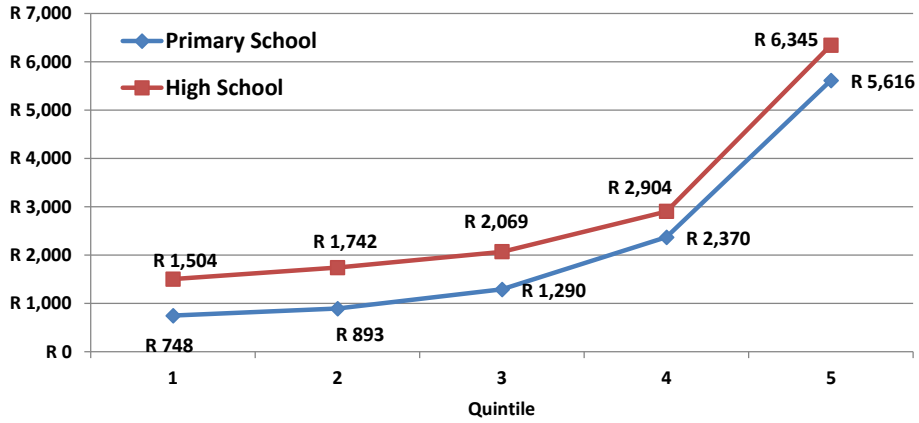
Figure 5: School fees by household expenditure quintile in primary and secondary school, 2004



Source: Own calculations from HSRC Survey

Other costs of education to households are also captured in the survey and shown in Table 12. Figure 6 shows total household expenditure per child, where it is evident that there is a substantial difference in spending across the quintiles, and less so between primary and secondary education.

Figure 6: Total household expenditure per learner by household quintile in primary and secondary schools, 2004



It is possible that changing circumstances may have influenced the composition of expenditure since this survey; two factors likely to have affected patterns of expenditure since were the introduction of the no fee policy in most schools, and the rapid expansion of the National School Nutrition Programme that now provides food in most schools. This is an important aspect for many parents, as the survey data below show that by far the two largest education-related expenditure items in poor households were food for school, and uniforms. It is likely that the further expansion of the Child Support Grant since the survey also had an ameliorating influence on poverty, and the school feeding programme is known to be highly appreciated in many poor communities.

Table 12: Expenditure per child in primary and secondary schools by expenditure item by household expenditure quintile, 2004

		Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	Average
Fees	**Primary**	R98.26	R104.40	R135.92	R628.62	R2 222.08	R566.72
	Secondary	R159.01	R361.34	R436.71	R1 078.59	R4 478.93	R2 294.20
Uniforms	**Primary**	R258.10	R273.72	R310.08	R421.73	R721.80	R381.99

	Secondary	R396.13	R405.09	R404.88	R501.20	R820.53	R504.39
Transport	**Primary**	R24.39	R17.36	R66.28	R244.77	R710.97	R189.66
	Secondary	R100.81	R90.37	R214.56	R311.42	R694.06	R282.34
Books	**Primary**	R26.33	R22.21	R34.08	R78.21	R205.33	R67.16
	Secondary	R69.01	R68.59	R91.94	R141.74	R261.57	R126.34
Stationery	**Primary**	R49.57	R45.31	R68.20	R126.25	R274.20	R105.13
	Secondary	R73.14	R76.25	R96.08	R137.00	R234.06	R123.14
Contributions	**Primary**	R9.02	R10.93	R65.20	R57.98	R89.47	R44.12
	Secondary	R26.91	R25.79	R47.49	R140.52	R105.88	R69.26
Food	**Primary**	R208.77	R297.73	R403.47	R597.19	R769.88	R438.89
	Secondary	R551.18	R640.68	R653.42	R681.04	R721.67	R649.93
Boarding	**Primary**	R14.82	R0.39	R22.53	R12.46	R64.09	R20.99
	Secondary	R5.37	R38.23	R70.91	R71.82	R181.46	R73.83
Private	**Primary**	R8.76	R39.87	R78.80	R29.69	R229.27	R70.95
	Secondary	R14.70	R49.22	R85.38	R52.75	R227.28	R86.16
Trips	**Primary**	R50.34	R80.13	R105.14	R156.23	R293.50	R129.69
	Secondary	R106.62	R144.90	R145.09	R187.24	R282.29	R172.98
Other	**Primary**	R0.11	R0.98	R0.38	R16.80	R35.08	R9.50
	Secondary	R1.34	R1.90	R1.41	R9.14	R16.45	R5.99
Total	**Primary**	R748.47	R893.03	R1 290.08	R2 369.93	R5 615.67	R2 024.80
	Secondary	R1 504.22	R1 902.36	R2 247.87	R3 312.46	R8 024.18	R4 388.56

Other surveys of expenditure show that aggregate education spending tends to be regressive, i.e. that it makes up a higher proportion of income amongst poorer groups. Although school fees had not been abolished at the time, fees were a relatively small part of overall education spending per learner amongst the poorest quintiles of households, generally constituting at the time less than one-fifth of all household spending on education in the bottom three quintiles of the household distribution. Thus the abolition of school fees in schools most frequented by the poor would have had only a minor effect on the financial situation of such households, an annual amount equivalent to only about one month's child support grant in the case of households receiving such grants.

In contrast to this, school uniforms are a more regressive expenditure item with larger consequences for the poor. Cost of school uniforms remain a large burden on the poor, and probably by now the largest education spending burden particularly since the no fee policy and the expansion of school feeding.

Conclusion

Although it is not possible to say with certainty in the absence of a recent survey of household expenditure on education, it is likely that school uniforms are now the largest expenditure item for poor households. Contributions (not always voluntary) may have risen where school fees had been abolished. School fees are still high in the more affluent schools, but if the fee exemption policies are applied, they should not deter poor people from attending such schools, where they can gain access.

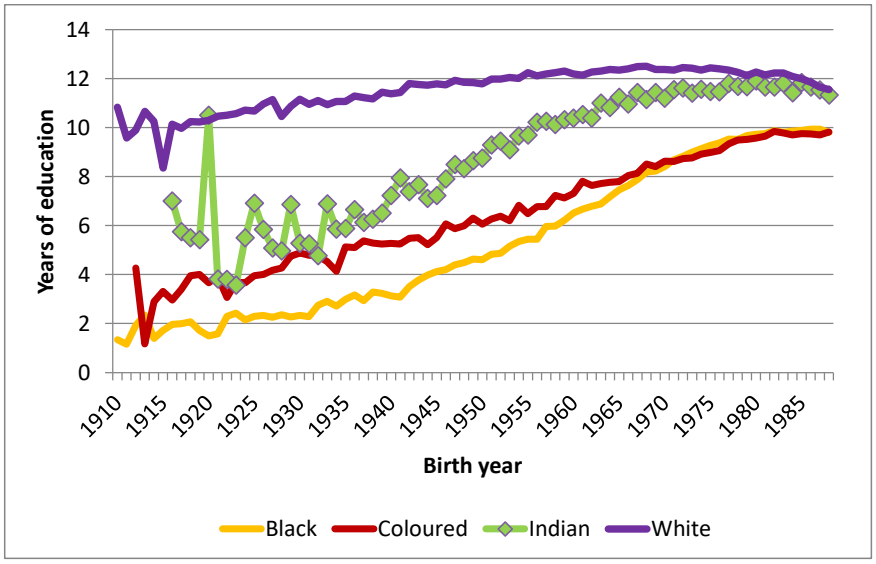
Overall, the level of school expenditure is such that it cannot really be regarded as an impediment to attending school for almost all South African school children. Consistent with that we find that there has been close to universal school enrolment (though not necessarily attendance) since even before the political transition, in the age group up to 15 years. For most children private finances do not act as a deterrent to obtaining school education, but may have an important influence on what part of the school system a child attends. Unfortunately that is still a matter of grave influence for educational outcomes and life chances, because of the poor functioning of such a large part of the school system. That is an issue that is again discussed in the next section of this report.

Section D: Equity in South African schooling: An analysis of social gradients

Educational outcomes in South Africa: The context

Present day inequalities in South African educational outcomes still reflect the country's colonial and apartheid past, in which educational and labour market opportunities differed systematically on the basis of race. On the face of it, inequalities with respect to access to education have been diminishing over time. Figure 7 shows the mean years of education by year of birth for each race group. The figure demonstrates that the racial attainment gaps are larger amongst older generations of South Africans and have been narrowing amongst younger cohorts.

Figure 7: Mean attainment by year of birth and race



Source: Community Survey (2007)

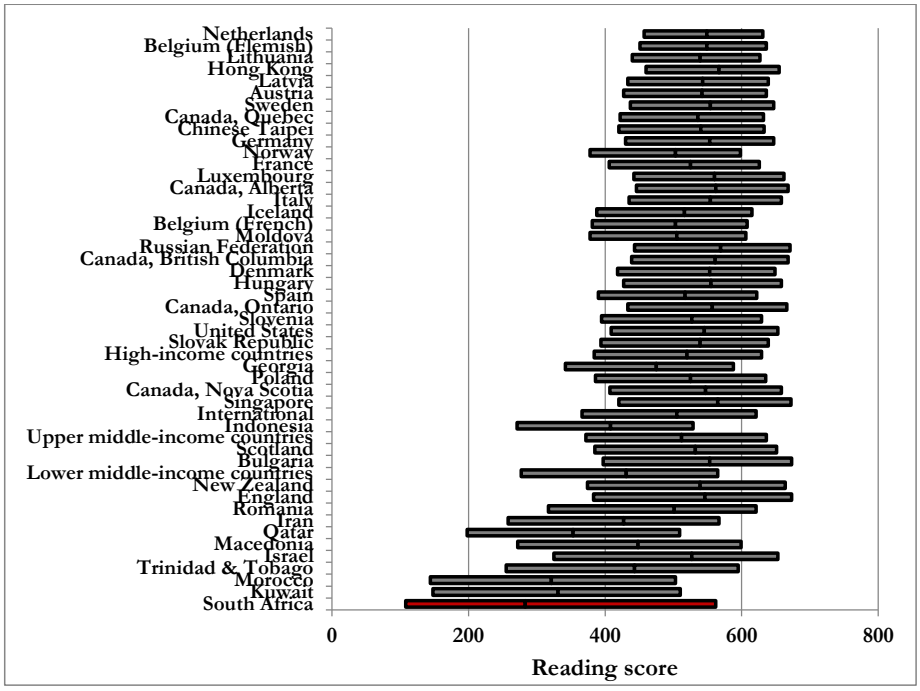
Despite this positive long-term trend in which access to schooling has become virtually universal, South Africa's participation in several international assessments of educational achievement has revealed disturbingly low levels of reading, mathematics and science performance amongst the majority of the country's children. In the Trends in International Maths and Science Study (TIMSS) of 2002 grade 8 South African students achieved the lowest average scores in both mathematics and science out of 46 countries, including six African countries. Similarly, South Africa came last in the Progress in International Reading Literacy Study (PIRLS 2006) out of 40 countries. The SACMEQ[4] surveys of 2000 and 2007 have demonstrated that South African children are performing slightly below the average for Southern and Eastern African region in grade 6 mathematics and reading.

Not only is the average level of achievement particularly low but there is a wide variation in performance amongst South African children. Figure 8 shows the interval between the 5th and the 95th percentiles of reading achievement within each country that participated in PIRLS 2006. The countries are arranged in order of the size of the difference between the 5th and 95th percentiles of achievement. Clearly, South Africa has the greatest variation in achievement according to this measure.

Figure 8 therefore addresses one aspect of equity: how equally or unequally are educational outcomes distributed? However, a second question of equity is, "how seriously do factors such as poverty, historical oppression or physical disabilities disadvantage children educationally?" This Section focuses chiefly on the relationship between socio-economic status and educational outcomes. In places, distinctions are drawn between the historically different parts of the school system as this institutional dynamic remains an important channel through which socio-economic status affects educational outcomes.

[4] SACMEQ stands for the Southern and Eastern African Consortium for Monitoring Educational Quality.

Figure 8: 5th, 50th and 95th percentiles of reading achievement by country



Literature Review: Socio-economic status and educational outcomes

Mueller and Parcel (1981, quoted in Willms, 2004: 7) define socio-economic status as the "relative position of a family or individual on an hierarchical social structure, based on their access to, or control over, wealth, prestige, and power." Operationally, socio-economic status is typically represented by a proxy, such as education, occupation or income. When analysing school-based survey data, socio-economic status is usually measured by parent education, parent occupation or, as is done in this report, by a household asset-based index.

There are numerous channels through which socio-economic status can influence a child's educational outcomes. The educational disadvantage faced by poor children begins at birth and

continues throughout the school programme. Nutritional deficiencies have been shown to negatively impact on cognitive development. An inferior amount and quality of early stimulation has also been shown to hinder cognitive development amongst poor children. These and other factors conspire to create substantial inequalities in the cognitive ability of children across the socio-economic spectrum at the point of entering school (Lee and Burkham, 2002). Throughout the school process poor children are disadvantaged by resource shortages, a lack of educational support in the home, household labour, negative neighbourhood effects, etc. A further issue, typical in South Africa with its history of segregation, is that poor people tend to live in communities where there is a concentration of poor people. According to what is known as the "hypothesis of double jeopardy", people from poor backgrounds are educationally vulnerable, but poor people who live in poor communities are especially vulnerable (Willms, 2001: 55).

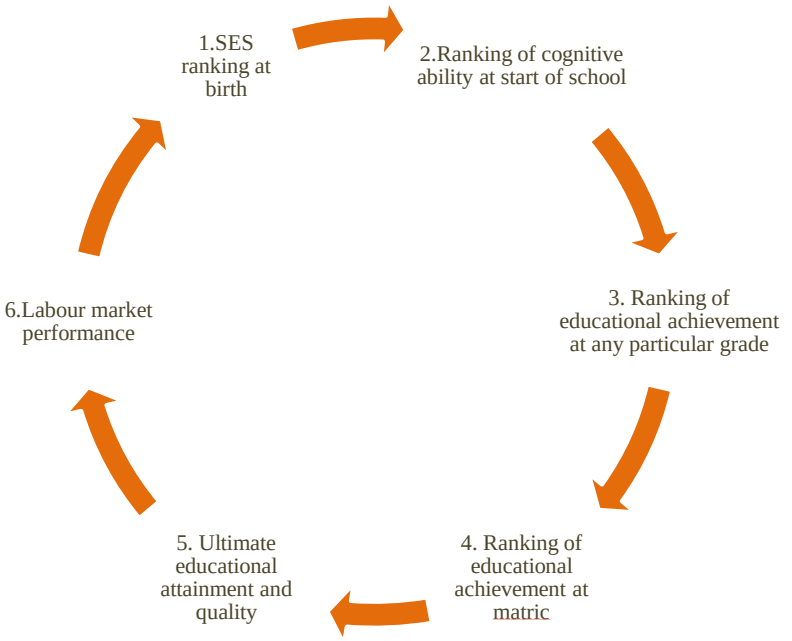
In the case of South Africa the relationship between socio-economic status and educational outcomes has additional complexity due to the overlap with race, as already described, and with language differences. The majority of South Africa's poor children begin schooling in their home language and then undergo a transition to English as the language of instruction in the fourth grade. Weak teaching of African languages, weak teaching of English, classrooms with learners having different home languages and poorly executed language transitions in many schools all lead to a substantial language disadvantage for many poor children.

There is an abundance of empirical evidence in the international literature that in virtually all societies there exist gaps in both educational attainment and educational achievement across socio-economic status. There is, however, a major debate in the literature about the extent to which socio-economic status determines educational outcomes, and therefore whether schools can be expected to make much of a difference. The famous Coleman Report (1966), which investigated schooling inequalities in the USA, brought a sharper focus to this debate. Coleman et al (1966) argued that the home background of students and of their peers was the overwhelming influence on educational outcomes, rendering schools somewhat impotent in raising outcomes for poor students. This finding has subsequently been both challenged and

supported. Heyneman and Loxley (1983) argued influentially that Coleman's findings were applicable only to certain developed country settings, but that in most of the developing world schools indeed have a significant impact on educational achievement. This became known as the Heyneman-Loxley effect. A further two decades later Baker, Goesling and Letendre (2002) asserted that the Heyneman-Loxley effect had vanished due to the strengthening of the link in developing countries between socio-economic status and the quality of schools children attend. This sorting into schools according to socio-economic status is particularly relevant for South Africa, and will be discussed extensively in a subsequent section.

The extent to which socio-economic status influences educational outcomes is significant because of the key role that education plays in social mobility. The schematic diagram presented in Figure 9 depicts social mobility as a series of snapshots over time. In the first snapshot individuals are born into a particular position along the socio-economic ranking. The figure then shows snapshots throughout the trajectory of an individual's educational development and into the labour market. Snapshot 6 ultimately feeds back into snapshot 1 reflecting the intergenerational nature of the process.

Figure 9: Schematic diagram representing the role of education in social mobility



The point made by the diagram is that the ranking at each point in time influences each subsequent ranking. While there is substantial evidence to account for the links between the various stages, what is less certain is the strength of these links in particular societies. As discussed already, the effects of socio-economic status on the cognitive development of children are observable very early in life, thus producing the link between Snapshots 1 and 2 in the figure. Feinstein (2003), for example, has shown that by the age of 22 months substantial differences in cognitive ability have opened up between high and low socio-economic status children. Feinstein (2003) followed the development of children using panel data with test scores at age 22 months, 42 months, 60 months and 120 months, and their ultimate educational attainment at age 26. The test scores at 22 months were indeed correlated with educational attainment at age 26. Feinstein (2003) observed considerable upward mobility amongst affluent children who initially performed

poorly, especially between 22 and 42 months of age. Amongst poorer children, those with low initial scores tended to remain near the bottom of the rankings while those with high initial scores were prone to slipping down the ranking, especially during the phase between 22 and 42 months.

While socio-economic status continues to exert a direct influence on outcomes at Snapshots 2, 3, 4 and 5, it has an indirect impact through its influence on prior outcomes. This is due to the hierarchical nature of learning in which all learning builds on prior learning, as Heckman (2006) argues. Heckman tracked the academic progress of children of varying socio-economic status from age 6 to 12. He found that gaps in achievement were fairly stable by the third grade and that schools were limited in their ability to narrow these gaps thereafter. According to Heckman, "the mastery of skills that are essential for economic success and the development of their underlying neural pathways follow hierarchical rules. Later attainments build on foundations that are laid down earlier."

The so-called "earnings function" literature provides evidence for the link between educational outcomes and labour market performance. This vast literature demonstrates that educational attainment and the quality of that education is predictive of employment and of earnings amongst those employed. The South African earnings function literature demonstrates that in this country the returns to additional years of education only become substantial once at least matric is attained. An implication of this is that many poor people find themselves in a poverty trap of low quality education leading to drop-out before matric and thus bleak labour market prospects.

Therefore, the extent to which children from disadvantaged backgrounds have a real opportunity to achieve educational outcomes that will enable them to be successful in the labour market is one indication of whether the school system can be expected to transform existing patterns of inequality or merely reproduce them.

The socio-economic gradient in South Africa

One way to depict the relationship of socio-economic status with educational achievement is by constructing socio-economic gradients. A socio-economic gradient is a graphical representation of the relationship between socio-economic status (SES) and a particular outcome of interest, such as health or education. Willms (1997, 2004) and Ross and Zuze (2004), amongst others, have applied variations of this technique to portray the effect of socio-economic status on educational achievement. Typically, socio-economic gradients rely on asset-based measures of SES due to the unavailability of household income information in school-based surveys. Research has corroborated that such asset-based indices are fairly well correlated with those obtained from income or expenditure data (Filmer and Pritchett, 2001). In order to create a simple linear socio-economic gradient one plots the estimates derived from an Ordinary Least Squares (OLS) regression equation with the following form:

$$\hat{Y}_i = \hat{\beta}_0 + \hat{\beta}_1 SES_i$$

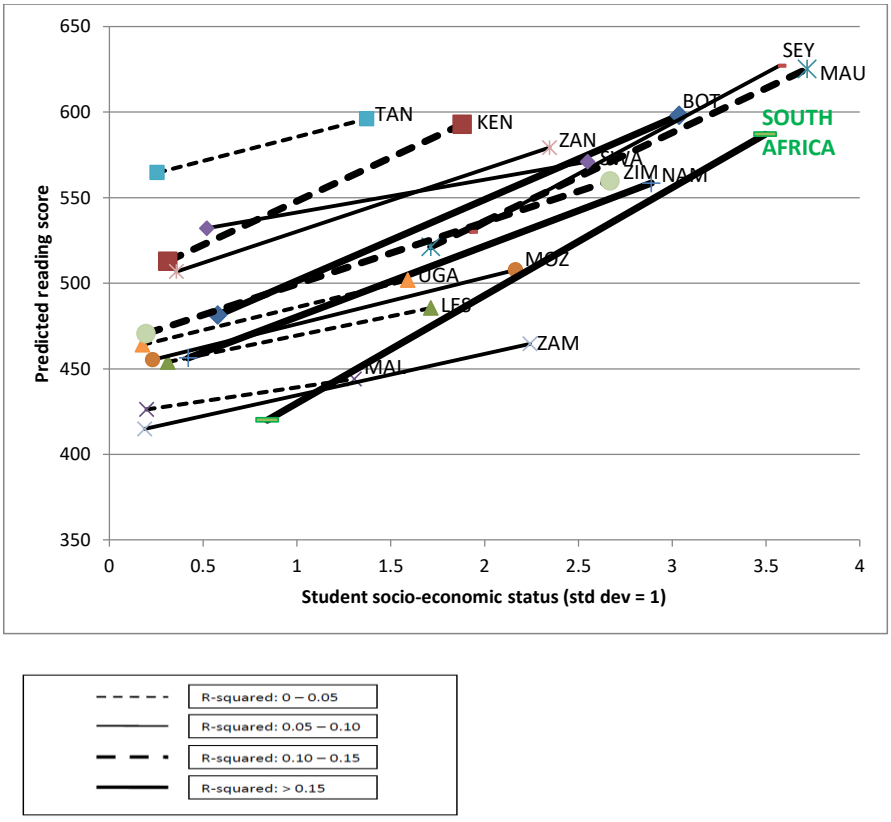
where $\hat{Y}_i$ is the outcome of interest, $\hat{\beta}_0$ is the intercept and $\hat{\beta}_1$ is the coefficient on the proxy for socio-economic status, which determines the slope of the line once plotted. When running an OLS regression of this form for South Africa using the SACMEQ 2007 reading scores and an asset-based index for SES[5] the following estimates were obtained:

$$\hat{Y}_i = 367.0 + 62.95 * SES_i$$

[5] This asset-based index was derived by applying Principal Components Analysis (PCA) to a number of variables reflecting the presence of various assets in the child's home. A similar technique was followed for those SES indices created from other datasets used in this paper. For more information on the use of PCA to derive asset-based indices of SES in school-based datasets see Taylor and Yu (2009).

The interpretation of this is that a one standard deviation increase in SES is associated with an increase in the expected reading score of 62.95 points. The basic socio-economic gradient for South Africa using these estimates is presented in Figure 10. In addition, the gradients for the other countries participating in SACMEQ in 2007 are depicted.

Figure 10: Socio-economic gradients in SACMEQ 3 (reading)

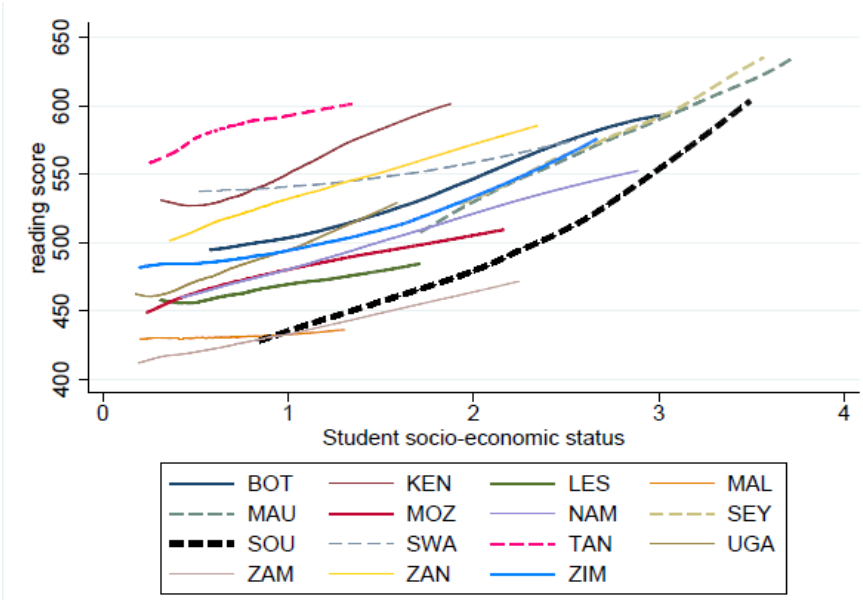


Note: Range is the 10th percentile to the 90th percentile of SES

The lines in the figure express several aspects of how education systems are performing. The level or *height* of the line captures the overall level of performance for the education system. Evidently, the line for South Africa is below those for most other countries in the sample. This means that poor children in South Africa are generally performing worse than equally poor children elsewhere. The *slope* indicates the extent to which reading scores vary with SES. The slope is therefore a measure of the educational inequality associated with socio-economic status. The slope coefficient of 62.95 indicates that for every one standard deviation increase in SES the predicted reading score increases by 62.95 points. As can be seen in Figure 10, South Africa has the steepest gradient. The *strength* of the gradient refers to how much of the variation in reading scores is attributable to SES. This is different from the slope: for example, if changes in SES were associated with fairly small changes in achievement (i.e. a gentle gradient) but if this were the only dimension along which achievement differed then 100% of the variation in achievement would be attributable to SES. The R-squared statistic is a commonly used indicator of the strength of the relationship. For South Africa, the R-squared statistic is fairly high and this is indicated by a thick line. The *length* of the lines is also interesting as the range of these have been limited from the 10^{th} to the 90^{th} percentile of SES within each country. South Africa has one of the longest lines indicating that there is a wide spread of socio-economic status within the country.

The linear form of the socio-economic gradients in Figure 10 is convenient for simplicity but is restrictive for expressing the true shape of the relationship between socio-economic status and achievement. Figure 11 shows gradients based on lowess regression, a locally weighted form of non-parametric regression, which allows the shape of the curve to be determined by the data rather than by a linear or quadratic model specification. The lines in Figure 5 confirm that in most cases the linear form is more or less appropriate. The South African line, however, becomes steeper at higher levels of socio-economic status. In subsequent gradients, therefore, a linear form is usually not used.

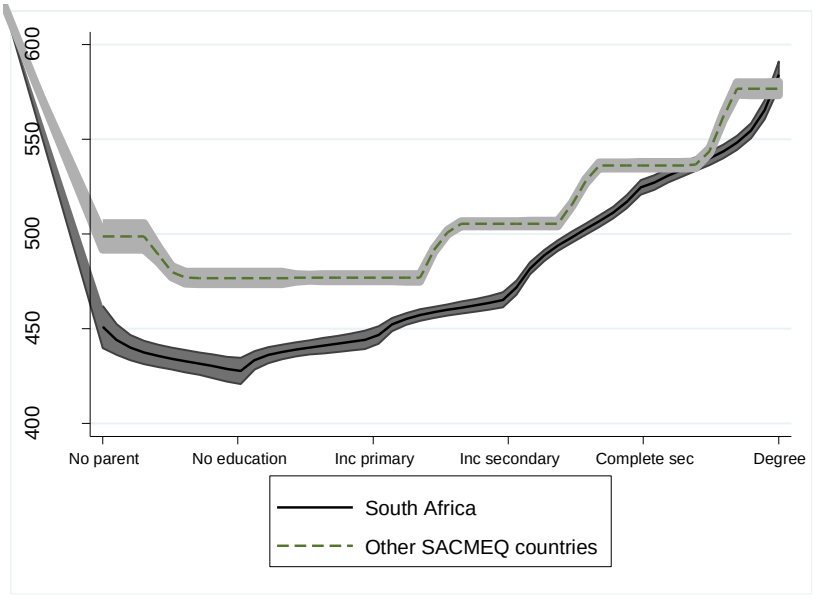
Figure 11: Lowess type gradients by country in SACMEQ 3 (student reading)



Note: Range is the 10th percentile to the 90th percentile of SES

Most of the analysis in this paper uses asset-based measures of socio-economic status. Figure 12 confirms that the basic pattern observed above is also evident when using parent education as a proxy for socio-economic status. The figure shows reading achievement for children with parents of various education categories. There are separate lines for South African children and for those in the remaining SACMEQ countries. It is clear that at lower levels of parent education South African children performed worse on average than those in the other countries. This pattern points to factors other than poverty that are negatively affecting outcomes in South Africa. If one considers poverty to be a type of binding constraint then this pattern suggests that South Africa still has room to improve efficiency and raise performance to a level nearer to the constraint imposed by poverty.

Figure 12: Smoothed local polynomial of reading score by parent education

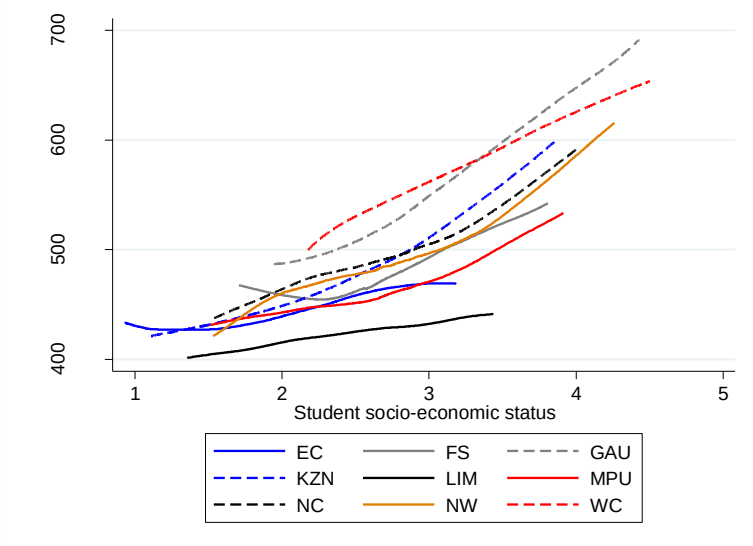


Notes: Grey bands represent 95% confidence intervals

Comparing socio-economic gradients across provinces also suggests that some provinces are better than others at producing educational achievement given poverty levels. Figure 13 depicts lowess-type gradients for each province. The figure indicates that the Western Cape and Gauteng provinces are more affluent than the others, but even after accounting for socio-economic status they performed better than the other provinces. In contrast, at every level of poverty children in Limpopo performed worse than those elsewhere. It is noteworthy that in multivariate regression using SACMEQ data, holding constant poverty and numerous other student, school and teacher characteristics, students in Limpopo still performed considerably worse than those in other provinces. This points to either some unobserved educational disadvantage or some systemic inefficiency in the Limpopo province. Again, one can interpret this in an optimistic vein: if

certain systemic inefficiencies in South Africa are reduced there is room for significant improvement in average achievement.

Figure 13: Lowess type gradients by province in SACMEQ 3 (student reading)



Note: Range is the 10th percentile to the 90th percentile of SES

Figure 8 depicts the performance of each province relative to average socio-economic status in a different way. Here the data is from the PIRLS 2006 study, in which grade 5 children were assessed. It is interesting, for example, that KwaZulu-Natal is poorer than Mpumalanga and roughly as poor as Limpopo yet outperforms these two provinces by a substantial margin.

Figure 14: Provincial averages of Reading and SES in PIRLS 2006

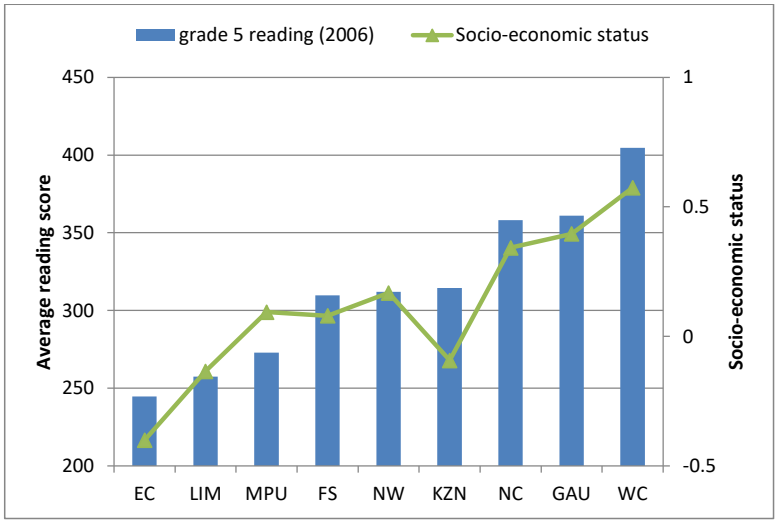


Table 13 provides an overall summary of the performance of provinces relative to socio-economic status based on analysis of various surveys. Overall, the Western Cape, KwaZulu-Natal, and to a lesser extent Gauteng, the North West and Northern Cape are the better performing provinces, while Limpopo and to some extent Mpumalanga are underperforming.

Table 13: Discretionary summary of provincial performance relative to SES, by data source

SACMEQ 3	
Under-performing provinces relative to SES	Well-performing provinces relative to SES
Limpopo Mpumalanga Eastern Cape (to some extent)	Western Cape & Gauteng (although SES is still driving some of this I think) Northern Cape North West KZN (to some extent)

NSES[6] 2007	
Under-performing provinces relative to SES	Well-performing provinces relative to SES
Limpopo	KZN North West Eastern Cape (to some extent)
NSES 2009	
Under-performing provinces relative to SES	Well-performing provinces relative to SES
Limpopo Free State	Western Cape North West KZN
PIRLS 2006	
Under-performing provinces relative to SES	Well-performing provinces relative to SES
Eastern Cape Mpumalanga Limpopo	Western Cape Northern Cape

The effect of socio-economic status mediated through schools

As explained earlier, one of the mechanisms through which socio-economic status affects educational outcomes is the sorting of children into schools of varying quality. In South Africa, poor children tend to be more concentrated together than in most other countries due largely to the residential segregation and school segregation between the race groups imposed during apartheid. As the Coleman Report (1966) demonstrated, there are strong negative peer effects in schools with a large concentration of poor children.

It is possible to include the school mean socio-economic status in the analysis of socio-economic gradients. Table 14 reports the results from a regression based on grade 4 literacy achievement according to the National School Effectiveness Study (NSES). The regression included the mean of socio-economic status in each school (entered with a linear, quadratic and cubic term to avoid

[6] The National School Effectiveness Study (NSES) was administered by JET Education Services and funded by the Royal Netherlands Embassy. It was a panel study of literacy and numeracy achievement in grades 3, 4 and 5 from 2007 to 2009.

forcing a straight line shape) and the socio-economic status of individuals. Due to the squared and cubic terms it is easier to interpret the results graphically. This is provided in Figure 14, which constitutes a type of socio-economic gradient. Movements along the horizontal axis represent changes in school mean SES, while the vertical width of the band of predicted values corresponds to variation in learner SES at given levels of school mean SES. Differences in the learner's own SES at given levels of school mean SES were associated with fairly small changes in the predicted literacy achievement, whereas a movement to the top end of the school SES spectrum was associated with a substantial increase in the predicted literacy score. Therefore, the combined SES of a school seems to have a larger impact on learner achievement than the learner's own SES, although the latter is no doubt key to determining which school students are able to attend.

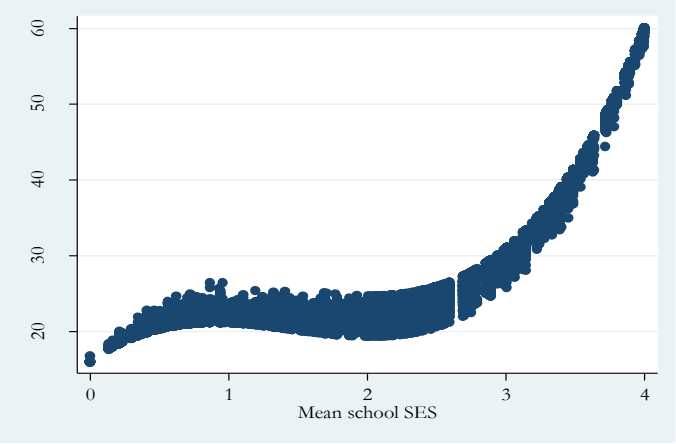
Table 14: The effect of SES on literacy scores: student level and school level combined

Dependent variable: (unweighted)	Grade 4 literacy score
Mean School SES	13.44***
	(1.46)
Mean school SES squared	-10.81***
	(0.75)
Mean school SES cubed	2.47***
	(0.11)
Student SES	1.51***
	(0.17)
Constant	16.03***
	(0.81)
R-squared	0.38
N	11813

* p<0.05, ** p<0.01, *** p<0.001

(Standard errors in parenthesis)

Figure 14: SES gradient for grade 4 literacy: Student and school SES combined (based on Table 14)

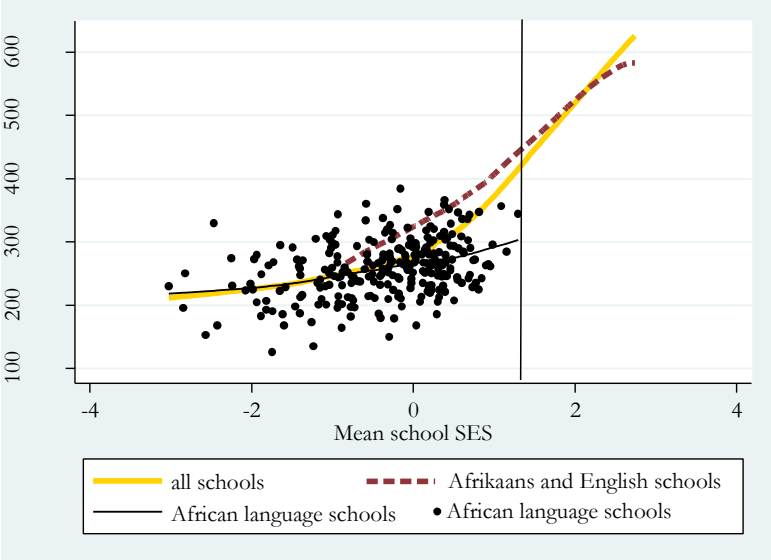


Socio-economic status determines, to a large extent, selection into the various historically different parts of the school system. Under apartheid there were separate education administrations for white, coloured, Indian and black schools as well as for schools in each homeland. Subsequently, there has been quite a bit of migration amongst middle class black children into the historically more privileged schools while the quality of schooling in historically disadvantaged schools has remained low. Several authors therefore argue that two differently functioning systems now exist within one (e.g. Fleisch, 2008, Van der Berg, 2008).

When analysing the PIRLS 2006 data, one can crudely divide schools into these historically different groups using the language in which schools chose to take the reading test. Those schools that took the test in one of the "African languages" (i.e. not English or Afrikaans) would almost certainly have been part of the historically black system. The second sub-system can be represented by those schools which took the test in English or Afrikaans and in which at least 30% of learners always spoke that language at home. Lowess-type socio-economic gradients for

these two categories of schools in PIRLS are depicted in Figure 15. The unit of analysis for this figure is the school. A scatterplot for the African language schools has also been superimposed.

Figure 16: Lowess-type gradients and scatterplot for sub-sections of the school system



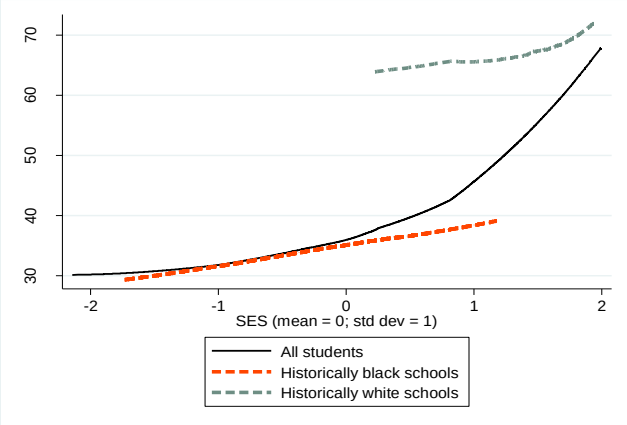
Source: PIRLS 2006

Figure 16 shows that the gradient for African language schools is rather flat and is to account for the flat part of the gradient for the full South African sample. On the other hand, the steep part of the South African gradient is entirely accounted for by the Afrikaans and English language schools. This indicates that two separate data generating processes are at work, causing the effect of SES to operate differentially in the two historically different parts of the school system. It is striking that not a single school that was tested in an African language scored above the low international benchmark score of 400. Also, there are no African language schools above a certain level of mean SES, denoted by the vertical line in the figure. Although one cannot be sure

that no historically black schools or schools predominantly attended by black children lay above these thresholds as some such schools may have taken the test in English, this does suggest that the dominant pattern in the historically black section of the school system is of low performance and concentrated low socio-economic status. This may relate to the phenomenon that the emerging black middle class has been withdrawing from the historically black school system and migrating to historically white, coloured and Indian schools (Soudien, 2004: 107). Children in historically black schools are performing poorly in general, while those black children who can afford to are exiting the system. Therefore, one can regard the effect of socio-economic status on educational achievement in South Africa as a two-step process: home SES is crucial in determining which part of the school system one enters; then for those in historically black schools the prospects of achieving high quality educational outcomes are bleak, regardless of home SES.

Figure 17 shows a similar analysis using the NSES data. Information about the historical education department of schools in the NSES was obtained from the Department of Basic Education's master list of schools. This allowed a more concrete distinction between the historically different parts of the school system. Again, it is clear that the overall socio-economic gradient for South Africa in fact conceals two separate processes. The gap in performance between those in the two groups of schools in the area in which the socio-economic status of learners overlaps makes it clear why one might wish to migrate to the better-performing system. However, to some extent this performance gap might be attributable to differences in unmeasured aspects of socio-economic status.

Figure 71: Lowess-type gradients for historically different parts of the school system



Note: The range of the "Sub-system" gradients is restricted from the 5th to 95th percentiles of SES

Figure 18 provides a similar analysis although now the sample is restricted to children whose home language is not English or Afrikaans. The graph shows that at given levels of socio-economic status African language learners located in historically white schools achieved better literacy scores than African language learners in historically black schools.[7] This result is confirmed by Figure 19, which replicates this analysis using grade 8 mathematics scores from TIMSS 2002. Again, there may still be unmeasured aspects of socio-economic status or parent or child motivation that are to account for some of the observed performance gap. It is also likely that peer effects play a role in benefiting those African language learners located in Afrikaans/English schools. Nevertheless, it is likely that this analysis points to systematic inefficiencies within the historically black section of the school system. Taylor (2011), for example, has demonstrated that specific management and teaching practices, such as curriculum

[7] Similar figures were created for numeracy scores in the NSES and the picture was broadly similar, but these are not reported here.

planning and coverage, teacher absenteeism and assessment practices, differ systematically between the historically different groups of schools.

Figure 18: Lowess-type gradients for African language children in different sections of the school system, NSES 2009

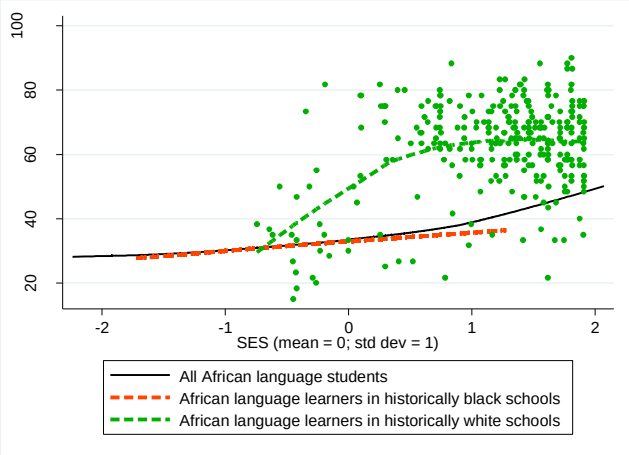
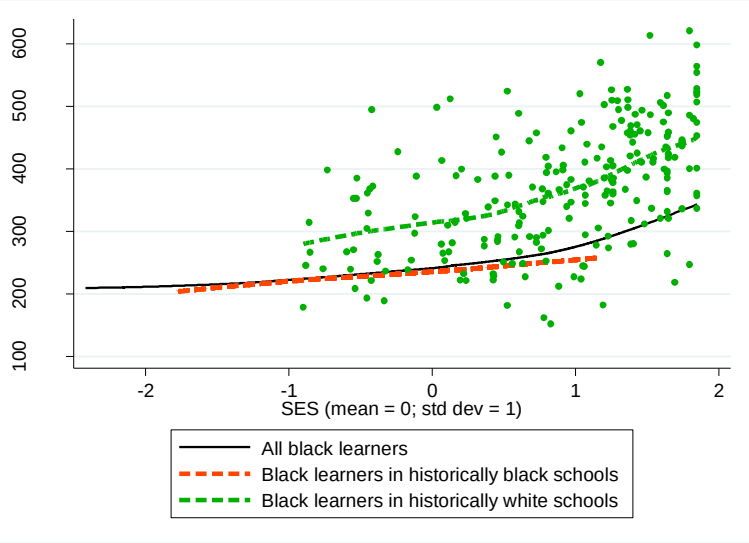


Figure 19: Lowess-type gradients for African language children in different sections of the school system, TIMSS 2002



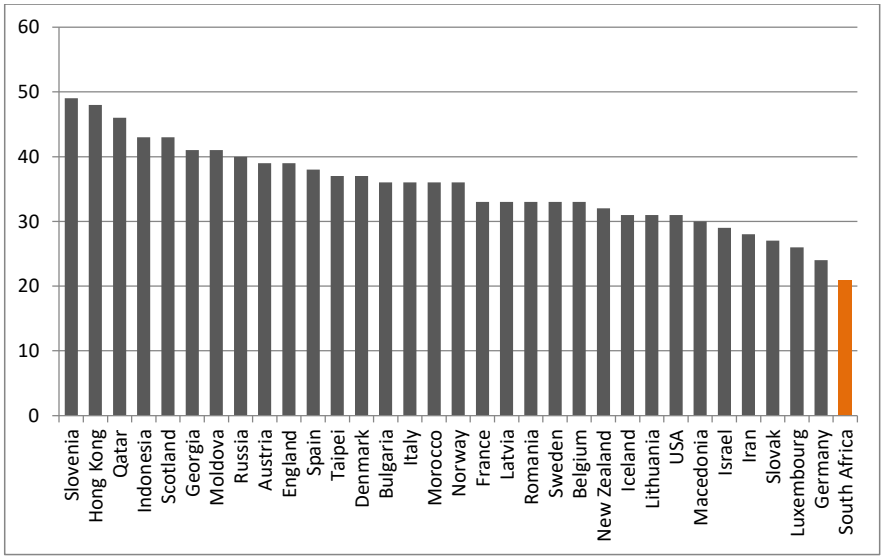
What happens to educational inequality as children progress through school?

The previous sections have demonstrated that considerable educational inequalities by socio-economic status exist at the start of school and at any point during the school process. An important question is whether these inequalities are widening or narrowing as children proceed through the school system. This determines whether the school system is serving as an institution of transformation or of reproduction.

The extent to which social mobility is possible will depend on the extent to which poor children are likely to achieve relatively good educational outcomes. Figure 20 shows, for each participating education system in PIRLS 2006, the percentage of the poorest 20% of learners that scored above the national average of their country. In most countries between 30% and 40% of

the poorest students scored above the national average. South Africa had the lowest proportion of the poorest 20% of children scoring above the national average. This implies that in South Africa, poor students have the least chance of performing well relative to other children in their country. This reduces the prospects of upward mobility for poor South African children.

Figure 20: Percentage of the poorest 20% of learners that achieve above the national average

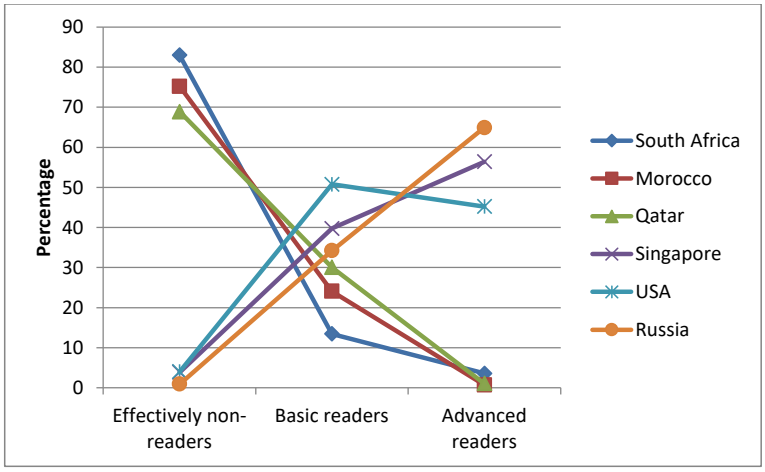


Note: Data is from PIRLS (2006). For the majority of countries the data refer to fourth grade children, although in South Africa fifth graders were tested.

Another key determinant of how effectively children will learn in school is how quickly and well they learn to read in the early grades. Reading is the gateway into all other learning, including writing, mathematics and other subjects. The PIRLS reading scores can be divided into 5 categories of competency. Children performing within the bottom category (scores below 400) are perhaps able to decode the text but are not effectively able to extract meaning from what they are reading. Trong (2009: 104) describes these children as effectively non-readers and "at serious

risk of not becoming literate." Those in the second and third categories (scores between 400 and 550) might be described as basic readers. Those in the fourth and fifth categories might be described as advanced readers. Figure 21 shows, for selected countries, the proportions of grade 4 children (and grade 5 children in the case of South Africa) that were achieving at these three levels of reading competency.

Figure 21: Proportions of the population at various levels of reading competency



Source: PIRLS 2006

According to this frame of analysis, more than 80% of South African children have not learnt to read effectively by grade 5. In contrast, the three well-performing countries depicted in the graph demonstrate that when a system is functioning well there should be virtually no children who are not able to read at least at a basic level by the fourth grade. Figure 22 shows the proportions reading at the three levels for those in African language schools and those in schools that took the PIRLS test in Afrikaans or English (and where at least 30% of children always spoke that language at home). Interestingly, the line for the Afrikaans/English group does not look very similar to the lines of the well-performing countries. Even in this group of schools a large

proportion of children have serious reading deficiencies after 5 years of school. However, about 95% of children in the African language schools could be categorised as having not yet learnt to read effectively. Even if these children do learn to read properly by the sixth or seventh grade, by that time they will surely have developed learning deficits in many other areas of learning, such as in mathematics.

Figure 2: Proportions at various levels of reading competency by "sub-system"

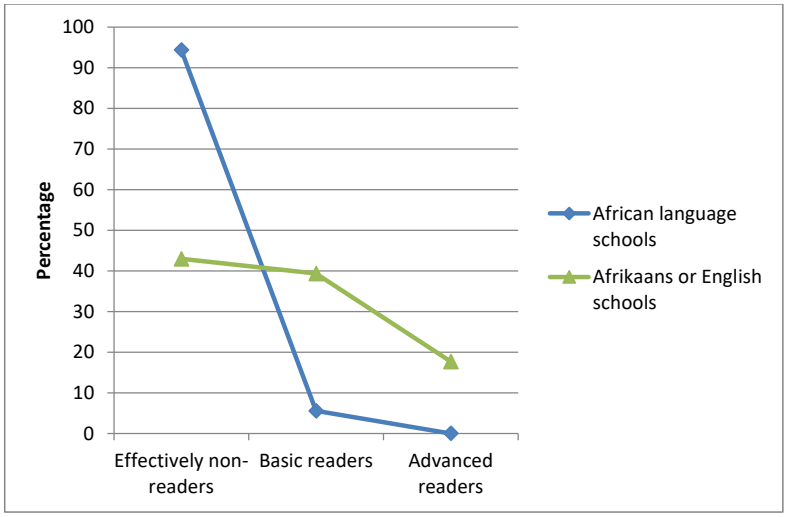
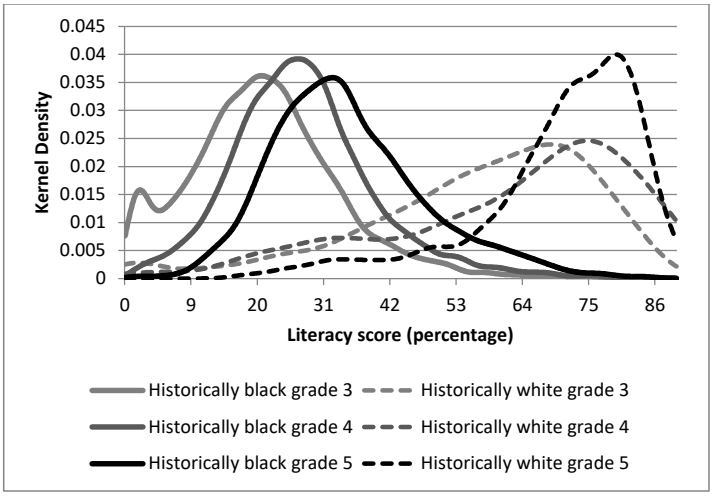


Figure 23 provides some perspective on the learning deficits that children attending historically black schools are suffering under. The kernel density curves show the proportion of children (along the vertical axis) that achieved various literacy scores (along the horizontal axis). The distributions of literacy scores are depicted for grades 3, 4 and 5 for historically black schools and for historically white schools. Importantly, the exact same tests were written by the same learners in all three years so that the observable improvements in the distributions of scores do reflect the learning that took place over the 2 year period. Although within each group of schools there appears to have been improvement from one year to the next, it is striking that the

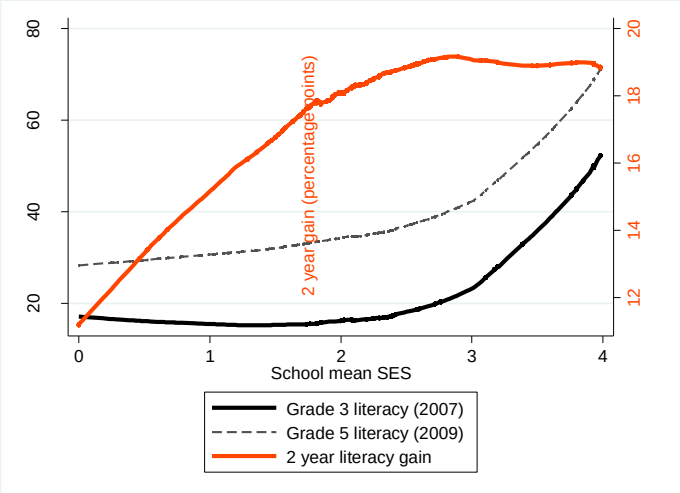
distribution of achievement for those in historically white schools in grade 3 is substantially better than the distribution for those in historically black schools in grade 5. This would indicate that by the fifth grade those attending historically black schools are already carrying learning deficits that amount to well over two years of education. The picture for numeracy (not shown here) is essentially the same.

Figure 23: Kernel Density curves of grades 3, 4 and 5 literacy by ex-department (NSES data)



The following graph, also based on NSES data, shows lowess-type socio-economic gradients for literacy in grades 3 and 5 and as well as the 2 year gains for those of varying socio-economic status. The basic shape of the socio-economic gradient remains the same over the two years, only moving to a higher level of achievement. Importantly, those of higher socio-economic status had higher learning gains over the two years, indicating a widening of the gap. If anything, this is an underestimate of the true widening of the learning gap because some of the best-performing high-SES learners would have scored highly in grade 3 and thus been limited by a ceiling effect from registering great gains.

Figure 24: Literacy scores and literacy gains by school mean SES



The following figure considers the relative performance of children of varying socio-economic status at subsequent points in the school programme. In each of the datasets that were used, children were split into 5 quintiles of socio-economic status (using similar asset-based measures). At the same time, the distributions of achievement were split into percentiles, effectively giving each individual a rank position between 1 and 100. The figure reports the average rank position for each quintile of socio-economic status at different points in the school programme. For grades 3, 4 and 5 the same individuals remained in each quintile thanks to the panel nature of the NSES data, making the rank positions across these 3 years directly comparable. For these 3 years there seems to be some evidence of divergence. In particular the average percentile ranking declined noticeably amongst those in the poorest 20% between grade 3 and grade 5. In subsequent years, the average rank position within each quintile remains fairly stable, although the richest 20% appear to pull away even further through secondary

school.[8]Note that the matric data used for Figure 25 comes from a dataset constructed by the HSRC through extracting the matric results of learners who had participated in TIMSS in 2002.

Figure 25: Average rank position by socio-economic status over time

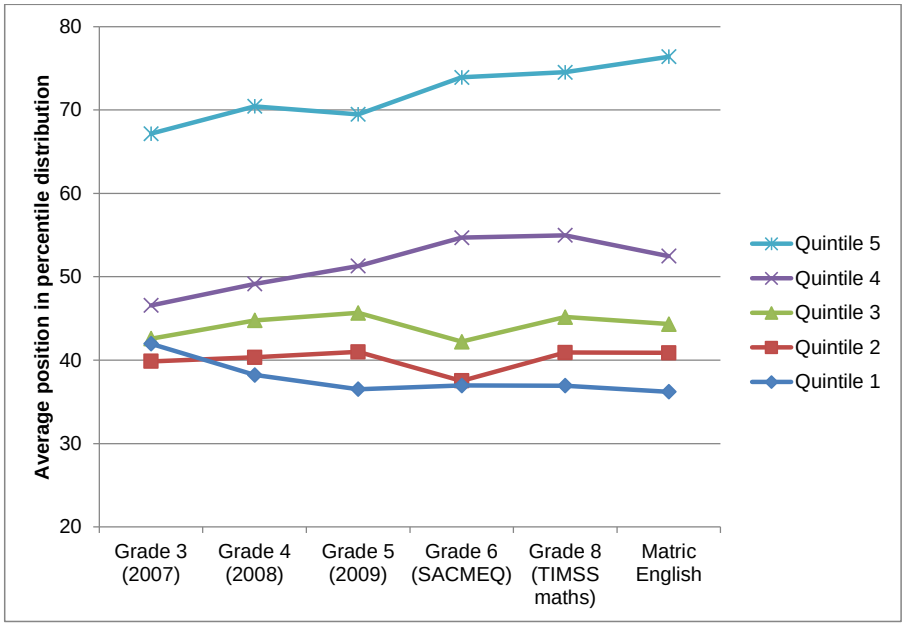


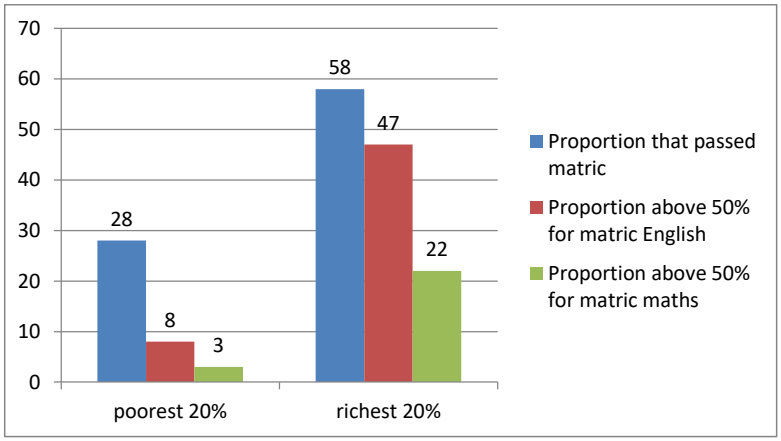
Figure 26 provides another indication of the probability of educational success for poor children. Of the poorest 20% of grade 8 children that participated in TIMSS in 2002 only 28% went on to

[8] The substantial drop-out that is known to occur just prior to matric probably means that the matric estimates in the figure understate the extent of divergence. Given that drop-out is more common amongst poor learners, some of the poorest 20% of matriculants may not have been amongst the poorest 20% of grade 8 learners. If one were to impute a very low matric English mark for those who dropped out of school prior to matric, this would no doubt pull down the average percentile position amongst the poorest 20%.

pass matric. Amongst the least poor 20% of grade 8 children in 2002, 58% went on to pass matric. These figures should be regarded as rough estimates. According to the Community Survey (2007), only 21% of the poorest 20% that reached grade 8 also went on to pass matric while 73% of the least poor 20% did so.[9] The Community Survey therefore suggests an even more unequal picture.

Figure 20 also shows that about 8% of the poorest 20% achieved at least 50% for matric English. For mathematics, only about 3% achieved at least 50% (i.e. 150 marks whether out of 300 on the standard grade or out of 400 on the higher grade). This implies that poor children have a low probability of reaching matric and achieving at a level high enough to enter highly skilled professions.

Figure 26: Proportions of grade 8 children that achieved various matric outcomes



[9] The calculation was performed using only those aged 21 or 22.

Various policies relating to funding rely on an official classification of schools into five so-called "poverty quintiles". While this classification was based on a measure of the poverty of the community within which schools were located, many schools have contested the quintile into which they were allocated and have consequently been shifted. As a result the "poverty quintiles" are by no means five equal-sized groups of schools. The incentive for schools to be classified in lower quintiles for the sake of higher funding is evident in the actual sizes of the various quintiles. According to the 2010 Master List of schools, roughly 34% of schools were Quintile 1 schools while less than 9% of schools were Quintile 5 schools.

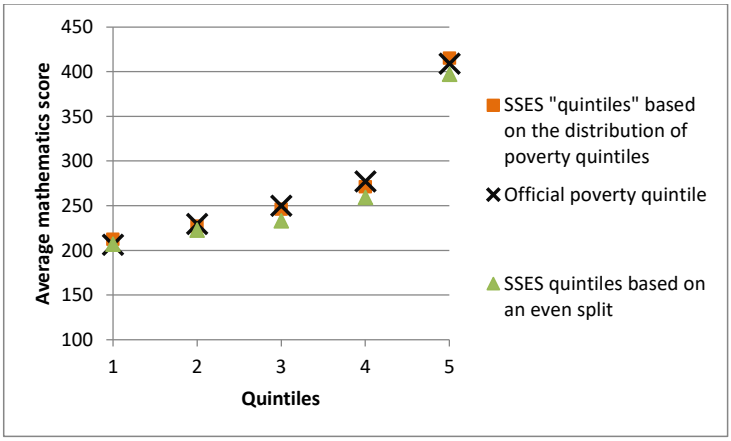
Often, when analysing survey datasets such as PIRLS, TIMSS or the NSES, one divides schools into five more or less equal-sized quintiles based on the mean socio-economic status within each school. The result is of course not the same thing as the official "poverty quintiles". The extent to which these two classifications correspond is relevant for both research and policy. It was possible to examine this issue through imputing the official poverty quintile information from the Department of Basic Education's Master List of schools into the TIMSS 2002 dataset and into the NSES 2009 dataset.

In each dataset, after ranking schools by the mean of student socio-economic status, schools were split into five categories in ascending order of socio-economic status but in accordance with the proportions given by the official poverty quintiles. For example, in the TIMSS dataset, 14.61% of learners were in official quintile 5 schools. Therefore, the most affluent 14.61% of learners (according to their mean school SES) were placed in the newly derived top "quintile". The correlation between the new "proportional socio-economic quintile" of schools and the official classification of schools was 0.63 in the case of the TIMSS dataset and 0.66 in the case of the NSES dataset. These are moderately large correlation coefficients, indicating that the official poverty quintiles are indeed a meaningful measure of socio-economic status.

Figure 27 shows average TIMSS grade 8 mathematics scores for each quintile, using three methods for classifying quintiles. Firstly, there is the official classification. Then there is the asset-based classification split proportionally to the distribution of the official poverty quintiles.

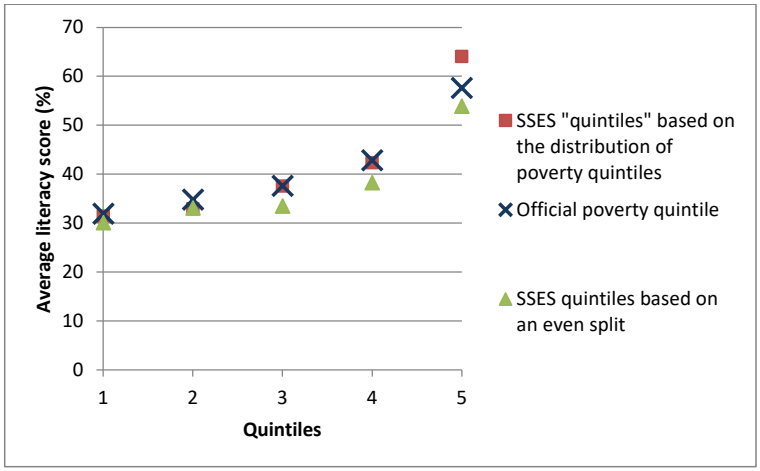
Lastly, there are school SES (SSES) quintiles derived through an even split of schools based on socio-economic status. The average performance for the official poverty quintiles appears pretty close to that for the two asset-based sets of quintiles. The quintiles based on an even split result in lower average scores for the higher quintiles because there are more quintile 3, 4 and 5 schools when split evenly than when split according to the official quintile proportions.

Figure 27: Average TIMSS mathematics scores for each quintile, variously defined



Applying the same method to the NSES data produces a broadly similar picture, as depicted in Figure 28. This confirms that the officially used poverty quintiles are a meaningful classification both in terms of distinguishing between the socio-economic status of schools and the performance of schools. The official poverty quintiles are therefore a meaningful classification for policy purposes. However, the official poverty quintiles have somewhat less explanatory power when used to predict educational achievement than the asset-based classifications. Therefore, the official poverty quintiles are slightly less useful for research purposes. The other pattern which corresponds to what is evident in the socio-economic gradients presented earlier is that there is a large jump in performance for the top quintile of schools. This again reflects the unequal nature of South Africa's school system with the small, affluent and historically privileged section of schools performing considerably better than the rest.

Figure 28: Average grade 5 literacy scores for each quintile, variously defined



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