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Measuring access to *learning* over a period of increased access to *schooling*: The case of Southern and Eastern Africa since 2000

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ABSTRACT

This paper examines the extent to which increased access to primary schooling in ten Southern and East African countries between 2000 and 2007 was also accompanied by increased access to actual learning. We develop a measure of access to learning that combines data on education access and learning achievement to measure the proportions of children in the population (including those enrolled and not enrolled) that reach particular thresholds of literacy and numeracy. In all countries there was greater access to learning in 2007 than in 2000. These improvements in access to learning especially benefited girls and children from poor households.

1. Introduction

There have been substantial expansions in access to schooling in Sub-Saharan Africa over the last few decades, although enrolment rates and grade survival rates in the region continue to lag behind the rest of the developing world (Easterly, 2009; Majgaard and Mingat, 2012). Meanwhile, the dismal performance of African countries in recent international assessments of educational achievement such as PISA, TIMSS, PIRLS and SACMEQ[1] has led many critics to argue that schooling which fails to produce learning is of limited value (Lewin, 2009; Pritchett, 2013). Furthermore, Hanushek and Woessmann (2008) have shown that the quality of education is more important than educational attainment in determining both the economic growth of nations and the labour market performance of individuals. Consequently, the call for a shift of attention from education access to education quality is now becoming familiar, and rightly so.

However, in much of the literature on schooling in Africa there is a notion, either implicit or explicit, that this increased access has caused a deterioration in the effectiveness of education systems to produce learning. Colclough et al. (2009, p. 2), for example, suggest that "in some African cases, the expansion of the primary system appears to have been accompanied by sharp declines in school quality, such that literacy and numeracy are no longer so readily delivered by the primary system." Chimombo et al. (2005, p. 16) maintain that the introduction of Free Primary Education in Malawi led to a deterioration in the quality of education being offered. Chimombo (2009, p. 309) argues that, "the impressive achievements made in improving access to school have to be balanced against issues of declining quality" and that the poor are most at risk of a consequently low quality education. Zuze and Leibbrandt (2011), citing the low quality of education observed in Uganda, suggest that the expansion of access to schooling should perhaps have been phased in more slowly so as to allow better planning and preparation. Crouch and Vinjevold (2006) argue that while many countries have managed to improve both access and quality, the region of Southern Africa is unique in that there has been an over-emphasis on access at the expense of learning, thus creating an imbalance between access and quality and therefore demonstrating the tension between access and quality. Most recently, when discussing education in sub-Saharan Africa Glewwe et al. (2014, p. 391) state that "the rapid increases in school enrolment almost certainly have reduced school quality as schools became overcrowded and existing resources were strained."

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[1] PISA stands for Programme for International Student Assessment; TIMSS stands for Trends in International Maths and Science Study; PIRLS stands for Progress in International Reading Literacy Study; SACMEQ stands for Southern and East African Consortium for Monitoring Educational Quality.

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There are a number of mechanisms through which one might expect increased access to schooling to cause a decline in quality, as measured by test scores: (1) the changing social composition of schools (i.e. an influx of disadvantaged children) is likely to drive down average scores even if the value added by schools remains unaffected; (2) the changing social composition of schools could negatively influence the learning outcomes of children who would have been enrolled even in the absence of the increased access through peer effects; (3) a strain on resources such as pupil–teacher ratios may reduce school effectiveness; and (4) if the expansion is driven by abolishing school fees this may weaken local accountability and hence school quality.[2]

To some extent, the perception of deteriorating quality arose due to a lack (until recently) of comparable test score data over time. For example, Kadzamira and Rose (2003, p. 511), who maintain that free primary education in Malawi had a negative impact on school quality, concede that they were not able to "compare what would have happened in the absence of the rapid expansion of enrolments nor with test results in previous years". Therefore, as test score data became available in recent years analysts, perhaps reasonably, suspected that the dismal performance may have been linked to the rapid expansions of earlier periods.

Perhaps to a greater extent, confusion about the relationship between educational access and school quality has arisen because measures of access, such as gross and net enrolment ratios, are invariably treated separately from measures of quality, such as country average test scores. Consequently, deteriorating education system quality is typically conceptualized as a decline in average test scores amongst those enrolled. This paper argues that education system quality should rather be conceptualized as the amount of learning that takes place in the overall population of children (those enrolled and those not enrolled). Measurement of this concept requires that grade survival data (access) be somehow combined with test score data (quality).

The bulk of the extant literature looks at *either* access *or* quality, but not both concepts simultaneously. This is problematic for two reasons: (1) observing access to education without regard for the quality of that education clouds the analysis, primarily because labour-market prospects are driven by cognitive skills acquired, not only years of education attained, as discussed above[3]; (2) analysing the quality of education – primarily through cross-national studies of educational achievement – without taking cognizance of the enrolment and dropout profiles of the countries under review is likely to bias the results. Countries with lower enrolments and higher dropout rates perform better on average, than otherwise similar developing countries that have higher enrolments and fewer dropouts (Lambin, 1995). This is because those not enrolled tend to be from poorer home backgrounds with lower socio-economic status and parental education than those who already attend school.

A further reason for the confusion around the relationship between education access and education quality is that quality, which can be defined in various ways, is often not clearly defined. School quality could be defined as the average performance (proxied by test scores) within a school. Or, it could be defined as the value-added by a school to its students, which allows for the possibility that one school may record lower test scores than another school but is more effective given its social composition of students. In this paper, the focus is primarily on the success of the education system as a whole in providing the entire population of children with access to learning. In this conception of quality, a successful education system is one in which children remain in school *and* acquire specific learning outcomes.

The principal innovation of this paper is in using a new method of combining educational access (grade survival) and quality (learning outcomes) and, in using this measure, examining changes in access to learning between 2000 and 2007 for ten African countries. The paper does not attempt to identify the causal effect of increased access to school on education quality, however quality is defined. Measuring the causal effect of increased access is problematic because many other factors change over time apart from access to schooling. These include economic growth, political dispensations as well as specific education policies. For example, economic growth may simultaneously contribute to increased access (through various mechanisms such as increased demand for schooling and increased government capacity to build schools) and to increased school quality (through for instance increased government ability to procure educational resources).

In order to estimate the causal effect of increased access one would therefore require some exogenous factor (unrelated to school quality) that caused some countries or regions to expand school participation, thus creating a natural experiment. However, we know of no such factor. Alternatively, one would need to identify a "treatment group" of enrolled students in a time period of "high access" and a similar "comparison group" of students enrolled in a time period of "low access". However, even if one is able to identify students with similar observable characteristics (such as parental education level) enrolled at two different time periods, these two groups will no doubt be different on unobservable characteristics (such as parental disposition towards education).

However, as Bold et al. (2011a, p. 36) argue, Free Primary Education and other Education For All policy initiatives provided a substantial supply-side shock. The evidence presented in this paper about the production of literacy and numeracy in countries that expanded access to schooling is therefore relevant to policy questions and development theory regarding expanding access to education.

Section 2 introduces the relevant data on access to schooling and learning achievement and defines a new combined measure of access to learning. Section 3 presents the main results of how access to learning changed in the ten countries under consideration between 2000 and 2007. Section 4 presents several extensions and robustness checks. Section 5 concludes.

2. Data and methodology

We argue that the salient goal for an education system is to increase the proportion of all children in the population who attain particular levels of academic performance.[4] Although previous initiatives such as the Jomtien declaration explicitly aimed for wider access to a better quality of schooling (e.g. article IV of the Jomtien Declaration), the policy response within countries and the monitoring of Education For All targets has largely focussed on either access or test score data, but without a suitable composite

[2] There may also be other less expected consequences of free primary education. Two recent studies find that abolishing fees in Kenya in 2003 created a perception of lower public school quality amongst parents (mainly signalled by higher pupil-teacher ratios), which led to substantially increased enrolments in private schools (Bold et al., 2011b; Nishimura and Yamano, 2013). As a consequence, public school enrolments stagnated while more affluent children migrated to the expanding private school sector. Moreover, Bold et al. (2011a) find that private schools caused improved performance amongst those attending with the result that overall education performance in Kenya remained stable despite the increased numbers of poor children attending public schools.

[3] Already in 1976 Blaug speaks about the "unresolved problem" in rate of return studies and explains that "students choose, not just schooling, but schooling of a certain type and quality, and few rate-of-return calculations have succeeded in successfully standardizing the calculated yields for quality of educational institutions" (Blaug, 1976, p. 841).

[4] While there are no doubt other important non-academic purposes of education, this goal is salient in so far as it is more relevant than merely increased school attendance or increased country average test scores.

Table 1
Country average scores, proportions of grade 6 children functionally literate and functionally numerate in 2000 and 2007.

Literacy	SACMEQ (2000)				SACMEQ (2007)			
Country	Average score	SE	Proportion functionally literate	SE	Average score	SE	Proportion functionally literate	SE
Kenya	546.5	4.6	94.4	0.8	543.1	5.1	92.0	1.0
Lesotho	451.2	3.1	70.6	2.0	467.9	2.9	78.8	1.3
Malawi	428.9	2.4	55.5	2.2	433.5	2.6	63.4	1.8
Mozambique	516.7	2.4	93.8	0.6	476.0	2.8	78.5	1.1
Namibia	448.8	3.5	56.6	1.5	496.9	3.0	86.4	0.8
South Africa	492.3	9.1	69.0	2.1	495.0	4.6	72.7	1.2
Swaziland	529.6	3.8	98.0	0.5	549.4	3.0	98.5	0.4
Tanzania	545.9	4.8	91.7	0.9	577.8	3.5	96.5	0.5
Uganda	482.4	6.2	74.5	2.2	478.7	3.6	79.7	1.3
Zambia	440.1	4.5	52.3	2.2	434.4	3.4	55.9	1.7
Numeracy	SACMEQ (2000)				SACMEQ (2007)			
Country	Average score	SE	Proportion functionally numerate	SE	Average score	SE	Proportion functionally numerate	SE
Kenya	563.3	4.3	89.3	1.0	557.0	4.1	88.8	1.0
Lesotho	447.2	3.3	34.1	2.1	476.9	2.6	58.2	1.6
Malawi	432.9	2.3	25.8	1.5	447.0	2.9	40.1	1.8
Mozambique	530.0	2.2	87.0	0.9	483.8	2.3	67.3	1.3
Namibia	430.9	3.2	23.4	1.4	471.0	2.5	52.3	1.4
South Africa	486.2	7.3	47.7	2.6	494.8	3.8	59.8	1.4
Swaziland	516.5	3.5	78.0	1.4	540.8	2.4	91.4	0.9
Tanzania	522.4	4.2	74.5	1.5	552.7	3.5	86.8	1.1
Uganda	506.3	8.3	61.2	2.6	481.9	3.0	61.3	1.6
Zambia	435.2	3.5	28.8	1.7	435.2	2.4	32.7	1.4

Data: SACMEQ.

measure. In another paper (Spaull and Taylor, forthcoming) we propose a single composite measure of education system performance that combines access to schooling with the quality of learning. This measure, which we call "access-to-learning", is the product of the proportion of children surviving to a particular grade (grade 6) and the proportion of children in that grade who attain specific levels of learning (functional literacy and functional numeracy).

2.1. Data on educational achievement

The best available data on learning outcomes in the Southern and East African region comes from the surveys conducted by the Southern and Eastern African Consortium for Monitoring Educational Quality (SACMEQ). SACMEQ is a collaborative network of 15 ministries of education that periodically conducts standardized surveys to assess the quality of education in Southern and Eastern Africa. The SACMEQ coordinating centre is located in UNESCO's International Institute for Educational Planning (IIEP). This paper focuses on the ten education systems in Southern and Eastern Africa that participated in both the last two rounds of the SACMEQ project (in 2000 and 2007) and have comparable household survey data that corresponds to these two periods. The ten education systems analyzed in this paper are Kenya, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Uganda and Zambia.[5]

The SACMEQ surveys tested reading and mathematics achievement amongst grade 6 students and collected extensive background information about the students as well as their schools and teachers. In 2000, SACMEQ tested 41,686 students in 2294 schools across 14 education systems (treating Tanzania and Zanzibar as separate systems). In 2007, with the addition of Zimbabwe, SACMEQ tested 61,396 students in 2779 schools across 15 education systems (Hungi et al., 2010). Administrative data on school enrolments were used as the basis for sampling. Consequently, the SACMEQ datasets contain a raising factor variable which inflates the sample to the estimated size of the grade 6 population, thus providing a measure of the number of grade 6 enrolments in 2000 and 2007 (Ross et al., 2005). In all calculations involving SACMEQ data the appropriate adjustments for complex sampling and weighting were made.

Table 1 reports the country average reading and mathematics scores in SACMEQ 2000 and 2007 for the ten education systems considered in this paper. The scores in the 2000 survey were set to have a scale average of 500 and a standard deviation of 100 across all students from all countries with sampling weights applied (Ross et al., 2005). The 2007 scores were then calculated on the same scale as the 2000 scores so as to ensure comparability. Zambia and Malawi had the worst-performing grade 6 students on average. In 2007, Tanzania had the best-performing grade 6 students in reading while Kenya had the best-performing students in mathematics. Most countries improved their average scores in both reading and mathematics between 2000 and 2007, especially in the cases of Namibia and Tanzania. On the other hand, average reading and mathematics scores declined in Mozambique and mathematics scores declined in Uganda.

Educational experts from SACMEQ have categorized scores in these tests into eight competency levels ranging from pre-reading (level 1) to critical reading (level 8) in the case of literacy, and from pre-numeracy (level 1) to abstract problem solving (level 8) in the case of mathematics (Ross et al., 2005). The eight competency levels for literacy and numeracy are described in detail by Hungi et al. (2010) and in an online appendix to this paper. According to this categorisation, children failing to reach level 3 in either reading ('basic reading') or mathematics ('basic numeracy') can be

[5] The other education systems in SACMEQ are Botswana, Mauritius, Seychelles, Zimbabwe and Zanzibar, which, though part of Tanzania, participated in SACMEQ as a separately analyzed education system. Zimbabwe participated in 2007 but not in 2000 and is therefore excluded from the present analysis. We were not able to locate comparable household data for Botswana, Mauritius and Seychelles. This is not too unfortunate since these countries have high levels of primary school participation and did not substantially expand access over the relevant period.

Table 2
Percentage of children enrolled in grades 1–6 by age for each country.

Country	Year of survey	Age 16	Age 17	Age 18	Age 19	Age 20	Age 21
Kenya	2007–2008	14.7	7.2	4.6	1.8	1.0	0.5
Lesotho	2009	10.2	6.0	2.2	1.1	1.0	0.1
Malawi	2010	23.4	12.5	7.5	3.9	1.5	0.9
Mozambique	2011	18.8	9.6	6.0	3.6	2.3	1.6
Namibia	2006–2007	8.2	3.9	2.2	0.6	0.7	0.7
South Africa	2009	3.9	1.2	0.6	0.5	0.2	0.0
Swaziland	2007	19.3	10.0	4.5	0.7	0.3	0.2
Tanzania	2010	7.4	2.4	1.2	1.1	0.1	0.2
Uganda	2010	43.6	22.2	7.6	4.3	1.3	1.4
Zambia	2007	14.3	12.8	4.8	2.4	1.7	1.0

Source: Own calculations using DHS and GHS (for South Africa) data.

regarded as functionally illiterate and functionally innumerate respectively. According to Ross et al. (2005, p. 262), "it is only at Level 3 that pupils can be said to read". Students who are functionally illiterate under this definition are unable to read a short text and extract meaning from it. Similarly, those who are functionally innumerate are unable to convert graphical information into fractions or interpret common units of measurement.

Table 1 also reports the proportions of grade 6 students that were functionally literate and functionally numerate in 2000 and in 2007, by country. In 2007, Zambia had the smallest proportions of grade 6 students that were functionally literate (56%) and functionally numerate (33%). Interestingly, Swaziland had the highest proportions of students reaching functional literacy and numeracy in 2007, despite not having the highest country average score in either reading or mathematics. This indicates that Swaziland has a relatively equitable school system that succeeds in providing basic skills to the majority of students. Namibia recorded the greatest improvement in the proportions of grade 6 children reaching functional literacy and numeracy between 2000 and 2007. In contrast, the proportions of students reaching functional literacy and numeracy declined substantially in Mozambique.

2.2. Data on access (grade 6 completion)

In addition to measuring the proportion of grade 6 children acquiring basic literacy and numeracy, one has to estimate the proportion of children who reach grade 6 in the first place, in order to arrive at a meaningful estimate of access to learning amongst the full population.

We obtain data on survival to grade 6 for these countries from the Demographic and Health Surveys (DHS), or strictly comparable data from other household surveys. In the case of Swaziland, we use the Multiple Indicator Cluster Surveys (MICS) and for South Africa we use the annual General Household Surveys (GHS). These surveys are all widely used for research purposes and contain comparable information on educational participation and attainment.

In order to estimate survival to grade 6 we make use of the question in these surveys on highest grade completed. This meant that we had to either use grade 6 completion rates (which underestimates the proportion of people who attend grade 6) or grade 5 completion rates (which overestimates the proportion of children who attend grade 6). Since the SACMEQ testing was conducted fairly late in the school year, we decided to use grade 6 completion rates.

An important question when estimating grade 6 completion rates is what age group of survey respondents to use. If the age bracket is too young there will be many children who have not yet completed grade 6 but will do so in time. This will lead to underestimating grade 6 completion. On the other hand, if the age bracket includes rather old respondents the resulting estimate of grade 6 completion will reflect access to schooling some years prior to the household survey. We decided on the optimal age bracket by examining the age-enrolment profiles of the countries in our sample. Table 2 shows the proportion of children enrolled in grades 1–6 by age for each country.[6]

Table 2 indicates the high levels of over-aged children that are enrolled in primary school grades. In Uganda, as many as 43.6% of all 16-year-olds were still enrolled in grades 1–6. It was decided that if a single-year age group had more than 5% still enrolled in grades 1–6 then that age group had to be excluded from the calculation of grade 6 completion rates. As evident in Table 2, 19-year-olds were the youngest single-year age group for which all countries satisfied this rule. The upper limit of the age bracket was set to 23-year-olds so as to include enough observations for an acceptable level of precision (i.e. small enough standard errors).

Since the best measure of grade 6 completion is obtained from 19- to 23-year-olds it has to be recognized that this reflects school participation several years prior. Unfortunately, comparable household survey data is not available on an annual basis for the countries in the sample, but only for certain years. Therefore, we used household data as close as possible to 2003 to reflect access to grade 6 in 2000 (when SACMEQ was administered) and household data as close as possible to 2010 to reflect access to grade 6 in 2007 (when SACMEQ was administered again).

While grade 6 completion amongst 19- to 23-year-olds is clearly not a perfect measure of access to grade 6, it is preferable to any other measure that we have considered. Gross Enrolment Ratios (GERs) and Net Enrolment Ratios (NERs) have several problems for the purposes of the current analysis.[7] Firstly, by definition GERs and NERs are strongly influenced by age-of-entry into school, grade repetition rates and drop-out patterns. For example, a high rate of repetition will artificially push up the GER because there will be more children enrolled in school at a time (numerator) while the size of the age-appropriate population (denominator) will remain the same. Secondly, GERs and NERs combine information from two sources of data, both of which are often unreliable in developing countries – administrative records of school enrolment numbers form the numerator while population estimates are used for the denominator. If both of these sources of information are inaccurate the error in the calculated GER or NER will be compounded (see UNESCO Institute for Statistics, 2010 for a full discussion).

Consequently, comparisons of GERs and NERs across countries and across time often present a misleading picture. For example,

[6] An online appendix shows stacked area plots of four categories of education status (not yet enrolled, currently enrolled in grades 1–6, dropped out prior to completing grade 6, and completed grade 6) by age for each country and various sub-groups within each country.

[7] The Primary GER, for example, is calculated by dividing the total number of primary school enrolments by the total number of children in the primary school-aged population.

the Primary NERs reported in the 2011 EFA Global Monitoring Report (UNESCO, 2011, p. 343) suggest that some very poor countries have higher rates of enrolment (e.g. Zambia – 95%, Uganda – 97%, Tanzania – 99% and Malawi – 91%) than many of the wealthier countries (e.g. Botswana – 87%, South Africa – 87%, Namibia – 89%). Similarly, the Primary GER for South Africa went down from 105% in 2002 to 93% in 2011 (DBE, 2013, p. 16). However, age-specific enrolment rates for each age cohort between 7 and 15 years old increased over the exact same period. A closer analysis suggests that the declining Primary GER reflects a combination of reduced grade repetition and possible over-estimates of the age-specific population in recent years (Gustafsson, 2012).

Another measure of access to grade 6 which we used in a preliminary version of this analysis (Taylor and Spaull, 2013) is the age-specific enrolment rate corresponding to the median age in each country's SACMEQ sample. However, this method overstates the proportion of children who reach grade 6 since many children of the median age (which is typically 13, 14 or 15) are still enrolled in an earlier grade and may not go on to complete grade 6, as discussed earlier in relation to Table 2.

Admittedly, grade survival rates based on household survey data are not without any potential weaknesses. These include sampling errors, household non-response, excluding homeless children from the sampling frame, and the fact that the sampling weights are based on census data, which is revised at fairly wide time intervals. However, these limitations are substantially outweighed by the advantages of using household data, namely, the methodological consistency across countries and time, the ability to calculate grade 6 completion rates, and – importantly – the ability to link information on grade 6 completion to other household characteristics such as socio-economic status.

Table 3 shows Grade 6 completion rates amongst 19–23 year-olds around 2003 and around 2010 for the ten countries in the sample. Arguably, these estimates provide a more meaningful picture of access to primary schooling in the region than most other commonly reported statistics, such as Gross Enrolment Ratios (GERs) or Net Enrolment Ratios (NERs). In both time periods, the grade 6 completion rate was highest in South Africa and lowest in Mozambique, although the increase over the interim period was the largest for Mozambique. In many of these countries there were substantial increases in the proportion of children who completed grade 6 (Kenya – 7%, Lesotho – 9%, Malawi – 7%, Mozambique – 96%, Swaziland – 12%, Tanzania – 11%, Uganda – 8% and Zambia – 8%).

When one considers these enrolment trends in combination with the educational achievement trends (Table 1) it is clear that there is a need for a combined indicator of education system performance. A comparison of South Africa and Tanzania demonstrates this. South Africa has the highest grade completion rate but a large proportion of functionally illiterate and innumerate grade 6 students. In contrast, a high proportion of Tanzanian grade 6 students reach functional literacy and numeracy but many children do not reach grade 6. Moreover, there is ambiguity regarding the development of the education system since 2000 in a case such as Mozambique where access to primary schooling increased impressively but the country average score declined. It is not immediately clear if the net effect was positive or negative.

There were also some countries where both access and country scores improved between 2000 and 2007, such as Tanzania, Lesotho and Swaziland. The 2011 EFA Global Monitoring Report recognizes this and argues that these trends "call into question the widespread claim that increased enrolment across the region has been universally accompanied by a steep decline in quality, implying a trade-off between learning levels and access" (UNESCO, 2011, p. 85). The EFA report, however, still uses separate measures of access and quality and therefore remains ambiguous about the cases of Mozambique and Uganda.

Table 3
Grade 6 completion rates around 2003 and around 2010 (19–23 year-olds).

Country	Circa 2003		Circa 2010	
	Year of survey	Grade 6 completion rate	Year of survey	Grade 6 completion rate
Kenya	2003	81.3 (1.1)	2007–2008	87.2 (1.0)
Lesotho	2004	71.3 (1.0)	2009	78.0 (1.0)
Malawi	2004	58.6 (1.3)	2010	62.9 (1.0)
Mozambique	2003	27.0 (1.1)	2011	53.0 (1.4)
Namibia	2000	82.5 (1.4)	2006–2007	85.4 (0.8)
South Africa	2004	94.0 (0.3)	2009	95.4 (0.3)
Swaziland	2000	76.7 (1.5)	2010	85.7 (1.5)
Tanzania	2004–2005	66.9 (1.7)	2010	74.1 (1.4)
Uganda	2006	63.4 (1.3)	2010	68.5 (1.3)
Zambia	2001–2002	68.6 (1.3)	2007	74.0 (1.2)

Source: Own calculations using DHS, MICS (for Swaziland) and GHS (for South Africa) data.
Note: Standard errors in parentheses.

2.3. Deriving a combined measure of access and learning

We propose a single measure of access-to-learning which is simply the grade 6 completion rate (from DHS) multiplied by the proportion of grade 6 students who reach basic literacy or numeracy (from SACMEQ). Using Kenya as an example, if one multiplies 81% (grade 6 completion rate according to DHS 2003) by 94% (proportion of grade 6 students reaching basic literacy in SACMEQ 2000) one gets to an Access-to-Literacy rate of 77%.

This method considers those who did not complete grade 6 to have been precluded from access to effective learning. We base this decision on several grounds. Firstly, it is unlikely that those who never enrolled in school would somehow have attained functional literacy and numeracy. Secondly, those who dropped out before grade 6 are likely to have dropped out due to socio-economic disadvantages or weak performance or a combination of these – Filmer and Pritchett (1999), for example, demonstrate the link between household wealth and school attainment. Given the strong relationship between socio-economic status and test scores, poor children who dropped out of school would have been predominantly located at the bottom end of the performance distribution (and hence functionally illiterate/innumerate) had they taken the SACMEQ test. For example, it is unlikely that the 26% of youths in Zambia who did not complete grade 6 (DHS 2007) would have been more numerate than the 67% of grade 6 students in Zambia who were enrolled but were functionally innumerate in SACMEQ (2007). Finally, even if it were the case that some children who did not complete grade 6 had acquired functional literacy or numeracy, we maintain that such children have failed to acquire an educational outcome that is sufficient to provide favourable labour market and life prospects. Therefore it is fair to conclude that they were denied meaningful access to learning.

While it is important to track access to learning over time for countries as a whole, it is also relevant to examine changes in access to learning for various sub-groups, especially when these are known to represent vulnerable population groups. For this reason we also calculate access to literacy and numeracy separately by gender and by household wealth.

For the analysis by gender, the calculation is straightforward. For example, to calculate access to literacy amongst boys in Lesotho in 2007, one multiplies the proportion of boys that completed grade 6 (65%) by the proportion of boys enrolled in grade 6 who acquire basic literacy (76%) to arrive at an access-to-literacy rate of 50%.

We calculate access-to-literacy rates and access-to-numeracy rates for three categories of household wealth: the poorest 40% of the population, the middle 40% of the population and the richest 20% of the population. All DHS datasets since 2003 have wealth index and wealth quintile variables. The wealth indices in DHS datasets were constructed using information on assets (electricity, radio, television, bicycle and refrigerator), services (sanitation, drinking water and electricity), vehicles (motorcycle, scooter, car and truck), building material quality (floor, wall and roof material), ownership of agricultural land, employing a domestic servant and other country specific assets. Principal component analysis was used to derive the wealth indices (Filmer and Pritchett, 2001; Rutstein and Johnson, 2004; Wittenberg, 2009). For the datasets where wealth indices were not provided (the GHS surveys for South Africa, the MICS surveys for Swaziland, the 2000 DHS for Namibia and the 2000/2001 DHS for Zambia) we derived indices for household wealth following the same methodology as far as possible, given that certain variables were not included in all these surveys. A similar procedure for deriving household wealth within the SACMEQ sample was followed using questions about household assets included in the student questionnaires, and applying principal components analysis.

Calculating access to learning within a particular wealth category is complicated by the fact that the distribution of wealth in SACMEQ does not correspond exactly to the distribution of wealth in household survey data. For example, the richest 20% of children in DHS represent the richest 20% of children *in the country*, while the richest 20% of children in SACMEQ represent the richest 20% of children *who reached grade 6*. To illustrate, if the grade 6 completion rate within the poorest 40% of the population was half that within the richest 20% of the population, then these two population groups should actually be represented by the same number of grade 6 students in SACMEQ.

Following this intuition, we arrange the distribution of students in SACMEQ from poorest to wealthiest and then divide the distribution on the basis of the grade 6 completion rates for each wealth group to obtain wealth groups in SACMEQ that represent the same underlying populations as the wealth groups in the household surveys. Mathematically, this process can be represented by the following formula, which would apply to any particular country in either time period:

$$\text{Total SACMEQ sample} = \int_0^{\left(\frac{CR_{poor40}}{0.4+CR_{total}}\right)\times N} CN_{ses} + \int_{\left(\frac{CR_{poor40}}{0.4+CR_{total}}\right)\times N}^{\left(\frac{CR_{mid40}}{0.4+CR_{total}}\right)\times N} CN_{ses} + \int_{\left(\frac{CR_{mid40}}{0.4+CR_{total}}\right)\times N}^{\left(\frac{CR_{rich40}}{0.2+CR_{total}}\right)\times N} CN_{ses}$$

where CR_{poor40} is the grade 6 completion rate for the poorest 40%, CR_{mid40} is the grade 6 completion rate for the middle 40%, CR_{rich20} is the grade 6 completion rate for the richest 20%, CR_{total} is the national grade 6 completion rate, N is the total population of grade six students obtained by inflating the SACMEQ sample to the population of grade six students using the SACMEQ raising factor variable "*rf2*", which is the inverse of the probability of selection into the sample (Ross et al., 2005, p. 36). CN_{ses} represents the cumulative distribution of the grade 6 population sorted from poorest to wealthiest. The first integral represents the SACMEQ students who correspond to the poorest 40% of 19- to 23-year-olds from household data, the second integral represents the SACMEQ students who correspond to the middle 40% of 19- to 23-year-olds in household data and the last integral represents the SACMEQ students who correspond to the richest 20% of 19- to 23-year-olds in household data. Within each wealth category (integral) we observe the proportion that acquired functional literacy/numeracy and multiply this by the grade 6 completion rate for the corresponding wealth category to obtain access-to-literacy and access-to-numeracy by wealth category.

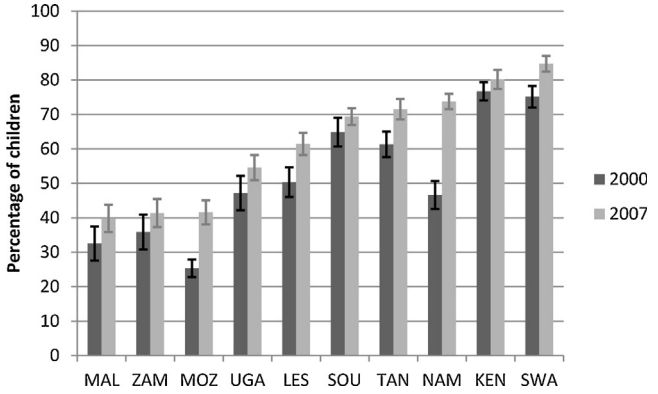

Fig. 1. Access-to-literacy rates in 2000 and 2007.
Source: Own calculations using SACMEQ in combination with DHS, MICS (for Swaziland) and GHS (for South Africa) data.

3. Empirical findings: access to learning since 2000

A technical appendix is available online, which reports grade 6 completion rates amongst 19- to 23-year-olds, the proportion of the SACMEQ sample reaching basic literacy and numeracy, access-to-literacy rates (grade 6 completion rate multiplied by the proportion of grade 6 students that reached basic literacy) and access-to-numeracy rates (grade 6 completion rate multiplied by the proportion of grade 6 students that reached basic numeracy). All statistics are reported for the years 2000 and 2007, for all ten countries and for the following sub-groups: boys, girls, the poorest 40% of the population, the middle 40% of the population, the richest 20% of the population, the poorest 40% of boys, the poorest 40% of girls, the middle 40% of boys, the middle 40% of girls, the richest 20% of boys, and the richest 20% of girls.[8] Standard errors are also reported.

3.1. Access-to-literacy and access-to-numeracy rates in 2000 and 2007

Fig.1 shows access-to-literacy rates for all ten countries in 2000 and 2007. Fig.2 shows the same information for numeracy. The figures also indicate 95% confidence intervals of the estimated rates, which were calculated by combining the standard errors from the grade 6 completion rates with the standard errors from the proportion literate and numerate from SACMEQ. Since the two samples are independent, the standard error of the composite index is the square root of the sum of the squared standard errors.[9]

Figs. 1 and 2 indicate that the best performing education systems, according to the combined measures of access and learning, were Tanzania, Kenya and Swaziland. In contrast, the countries with the lowest access to learning were Malawi, Zambia and Mozambique. Some countries have similar access-to-learning rates but have different patterns in grade survival and in learning outcomes.

[8] The procedure for calculating access-to-literacy (or numeracy) rates when interacting gender and wealth, is the same as that for overall wealth, but done separately for the population of females and of males in turn.

[9] In a formula this is $SE_{COMPOSITE} = Sqrt((SE_{SACMEQ})^2 + (SE_{DHS})^2)$.

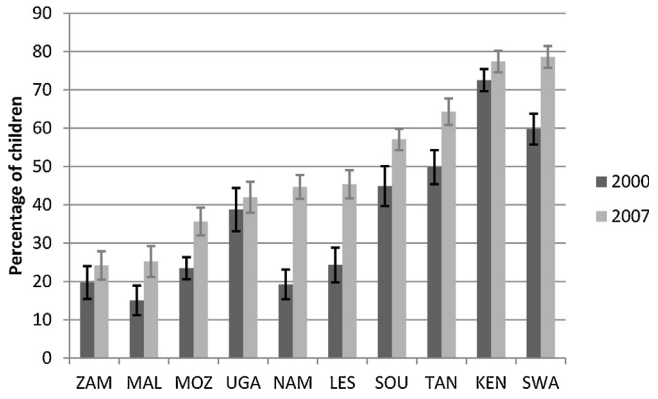

Fig. 2. Access-to-numeracy rates in 2000 and 2007.
Source: Own calculations using SACMEQ in combination with DHS, MICS (for Swaziland) and GHS (for South Africa) data.

For example, South Africa – with high grade 6 completion rates but low levels of learning amongst grade 6 students – has a similar access-to-literacy rate to Tanzania – with low grade 6 completion but high levels of learning amongst grade 6 students.

Perhaps the most striking feature of Figs. 1 and 2 is that in all countries access-to-literacy and access-to-numeracy improved between 2000 and 2007. In some countries the improvement was not statistically significant but in other countries the improvement was statistically significant and substantial (Mozambique, Lesotho, Tanzania, Namibia, Swaziland). Irrespective of the impact of expanded school participation on specific schools or individuals, this represents compelling evidence that a period of considerably expanded access to primary schooling was also accompanied by improved access to learning.

Fig.3 (for literacy) and Fig.4 (for numeracy) consolidates all the information about changes in grade 6 completion, changes in average test scores and changes in access to learning into a single graph. The horizontal axis shows the percentage point change in the grade 6 completion rate for each country. The vertical axis shows the ratio of access-to-literacy (or numeracy) in 2007 to access-to-literacy (or numeracy) in 2000. A ratio of above one means that access-to-literacy (or numeracy) was higher in

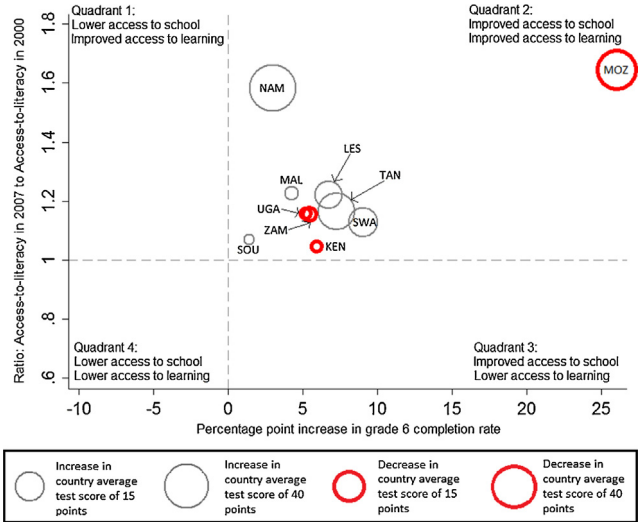

Fig. 3. Access to schooling and access to literacy over time.
Source: Own calculations using SACMEQ in combination with DHS, MICS (for Swaziland) and GHS (for South Africa) data.

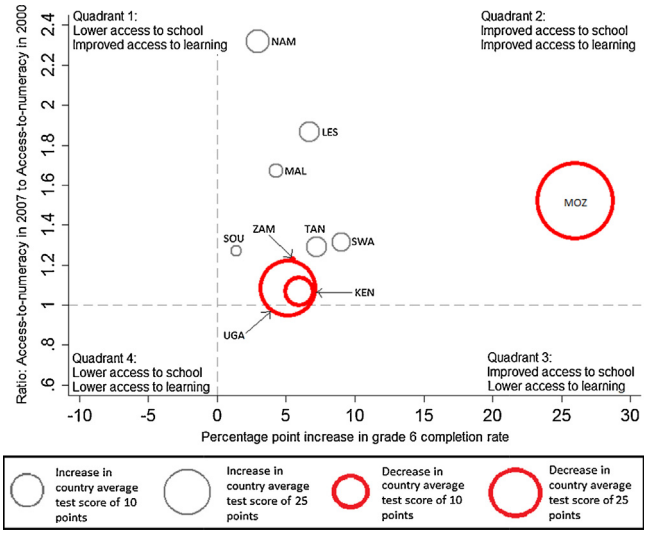

Fig. 4. Access to schooling and access to numeracy over time.
Source: Own calculations using SACMEQ in combination with DHS, MICS (for Swaziland) and GHS (for South Africa) data.

2007 than in 2000. The size of the bubbles indicates the magnitude of the change in the country average test score between SACMEQ (2000) and SACMEQ (2007). For thick red bubbles the change in SACMEQ average score was negative while for thin black bubbles the change was positive.

The graphs show four quadrants corresponding to the four possible combinations of increases or decreases in grade completion (access) and increases or decreases in access to learning. For both literacy and numeracy, all countries are located in the top right quadrant, indicating that both access to schooling *and* access to learning improved over the period. Some countries improved access to learning between 2000 and 2007 without substantial changes in the grade 6 completion rate. Namibia is the chief example of this. Some countries (Tanzania, Swaziland and Lesotho) experienced higher grade 6 completion rates and still achieved higher average test scores. Some countries, most notably Mozambique, achieved improved access to learning in the overall population but experienced a decline in average test scores amongst those reaching grade 6.

Using the case of literacy in Mozambique, Fig.5 illustrates how improved access to learning for the population can be consistent with lower average test scores. The graph shows the numbers of grade 6 students in Mozambique who reached each of the eight competency levels of reading performance in 2000 and 2007. The

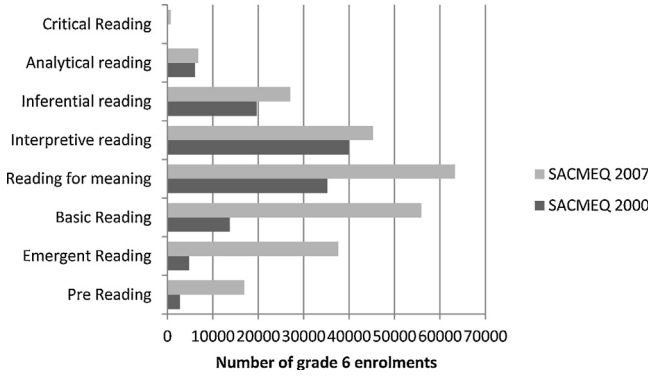

Fig. 5. Numbers of grade 6 pupils achieving at various performance levels in literacy in Mozambique in 2000 and 2007.
Source: SACMEQ surveys of 2000 and 2007.

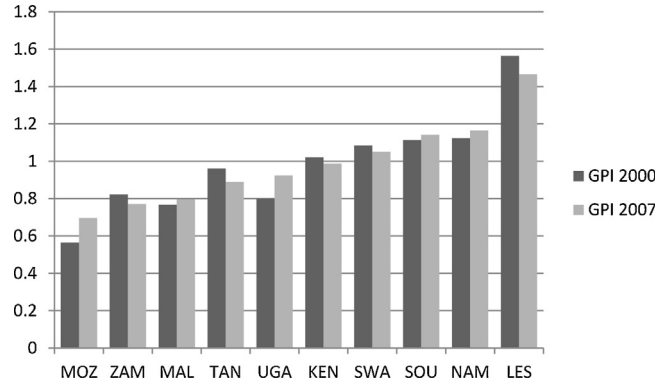

Fig. 6. Gender Parity Index with respect to Access-to-Literacy in 2000 and 2007. *Source*: Own calculations using SACMEQ in combination with DHS, MICS (for Swaziland) and GHS (for South Africa) data.

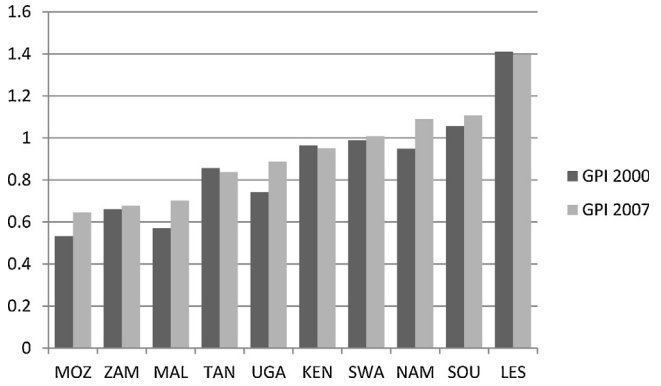

Fig. 7. Gender Parity Index with respect to Access-to-Numeracy in 2000 and 2007. *Source*: Own calculations using SACMEQ in combination with DHS, MICS (for Swaziland) and GHS (for South Africa) data.

numbers were obtained using the raising factor variable ("*rf2*") in the SACMEQ datasets.[10] From the figure there are two important findings worth emphasizing: (1) There was a shift in the distribution of performance with many more children achieving at lower competency levels (levels 1–3) in 2007 than in 2000; and (2) At every competency level there were more students in 2007 than in 2000 due to the expansion of the schooling system and including previously excluded children. The majority of those children bringing the average down in 2007 would not have been in school had the grade 6 completion rate of 2000 still prevailed. The fact that these previously excluded children were not included in SACMEQ (2000), but were included in SACMEQ (2007) (and achieved at relatively low levels) illustrates how a reduction in average test scores following a rapid expansion of access is not necessarily a negative outcome. The important thing here is that there were also more children reaching higher competency levels in 2007 than in 2000, even after adjusting for population growth. When one looks at the case of Mozambique in this way it would seem that expanded access to primary schooling was an unambiguously positive development. For the overall population of children, there was greater access to literacy in 2007 than in 2000.

3.2. Access-to-literacy and access-to-numeracy by gender

An online technical appendix reports access-to-literacy and access-to-numeracy rates by gender for all ten countries in 2000 and 2007. To facilitate an overview of the trends between 2000 and 2007, we derived a Gender Parity Index (GPI) for each of the two years, defined as the access-to-literacy rate for girls over the access-to-literacy rate for boys. Fig.6 shows this GPI for access-to-literacy in 2000 and in 2007. Fig.7 presents the same analysis for access-to-numeracy.

Based on Figs. 6 and 7, several points can be made about gender patterns in access to learning in the region. First, in relatively poor and in East African countries (Mozambique, Malawi, Uganda, Zambia) girls typically have lower access to learning than boys. Second, analysing only gender inequalities in access to schooling or only gender inequalities in test scores generally understates the overall gender gap in access to learning. For example, 64% of girls in the Mozambique SACMEQ sample had acquired basic numeracy compared with 70% of boys, which would yield a GPI of 0.90. The grade 6 completion rate for girls was 45% compared with 63% for boys, which would yield a GPI of 0.72. When combining these figures, however, the access-to-numeracy rate for girls is 29% compared with 44% for boys, which yields a GPI of 0.65 (See Lewis and Lockheed, 2006, 2007, for a further discussion of this "double disadvantage").

Thirdly, girls are outperforming boys in most Southern African countries, especially in Lesotho. In the case of Lesotho the disadvantage faced by boys is driven mainly by grade 6 completion rates (90% for girls compared to 65% for boys). This pattern is largely due to the cultural tradition in Lesotho where boys are responsible for herding livestock (Jha and Kelleher, 2006). Fourthly, access-to-learning GPIs in 2007 were lower in numeracy than in literacy for all ten countries, with the percentage point differential ranging from 3.4 in South Africa to 9.4 in Zambia. This is consistent with the traditional perception that numeracy tends to favour boys – though of course this result may not reflect an innate advantage for boys in numeracy, but rather the effects of a self-fulfilling socially constructed perception of such an advantage.

Fifthly, in most cases the GPI increased between 2000 and 2007, indicating a relative improvement for girls. In Mozambique, Uganda and Malawi, the improvement in access to learning for girls relative to boys was substantial. In these countries, the benefits of expanded access to primary schooling were enjoyed disproportionately by girls. This points to the equity-enhancing nature of the recent expansions in school access in the region.

3.3. Access-to-literacy and access-to-numeracy by household wealth

Table 4 shows access-to-literacy rates for the poorest 40%, middle 40% and richest 20% of households in all ten countries in 2000 and in 2007. Table 5 shows the same information for numeracy. In all countries the gap in access to learning between the wealthiest 20% of the population and the poorest 40% of the population is substantial. The inequalities in access to learning are clearly of a larger magnitude across the wealth dimension than by gender. The two right-hand columns in Tables 4 and 5 show the ratio of access-to-literacy (numeracy) rates amongst the poorest 40% to those amongst the richest 20%. For 2000 and 2007 and for both literacy and numeracy, the lowest ratios (i.e. most unequal) were obtained for Mozambique, indicating that in this country the poor are at an extreme disadvantage in having access to learning. For example, the access to numeracy rate for the wealthiest 20% of children in Mozambique (67%) was almost five times as much as that of the poorest 40% of children (14%).

The most encouraging trend that is evident in Tables 4 and 5 is that the gaps between the richest 20% and the poorest 40% in access to learning declined in most cases. For access-to-literacy, there was a decline in inequality in nine of the ten countries, while for numeracy there was a decline in inequality in eight of the ten countries. This reduction in inequality in access to learning was driven mainly by increased grade 6 completion rates amongst the

[10] The 2007 numbers of grade 6 pupils were deflated to adjust for population growth between 2000 and 2007.

Table 4
Access-to-literacy rates by socio-economic status in 2000 and 2007.

Country	2000		2007		2000		2007	
	Poor 40%	Mid 40%	Rich 20%	Poor 40%	Mid 40%	Rich 20%	Ratio: poor40:rich20	Ratio: poor40:rich20
Kenya	62.2	79.9	89.8	69.3	82.6	91.5	0.69	0.76
Lesotho	35.2	53.6	71.0	44.4	64.7	84.5	0.50	0.53
Malawi	19.9	29.4	59.5	24.1	40.3	63.2	0.33	0.38
Mozambique	6.4	21.0	51.7	17.3	39.7	77.0	0.12	0.23
Namibia	32.3	44.6	76.8	61.3	74.4	92.9	0.42	0.66
South Africa	48.8	67.6	93.2	53.8	73.7	93.0	0.52	0.58
Swaziland	67.3	75.8	85.3	76.2	85.6	93.0	0.79	0.82
Tanzania	37.3	68.4	86.5	54.3	75.5	90.8	0.43	0.60
Uganda	34.3	44.3	70.5	35.7	55.6	80.8	0.49	0.44
Zambia	16.3	36.6	70.9	25.0	39.6	67.7	0.23	0.37

Source: Own calculations using SACMEQ in combination with DHS, MICS (for Swaziland) and GHS (for South Africa) data.

Table 5
Access-to-numeracy rates by socio-economic status in 2000 and 2007.

Country	2000		2007		2000		2007	
	Poor 40%	Mid 40%	Rich 20%	Poor 40%	Mid 40%	Rich 20%	Ratio: poor40:rich20	Ratio: poor40:rich20
Kenya	58.5	75.6	85.4	66.7	79.8	88.5	0.68	0.75
Lesotho	16.5	25.2	36.7	30.7	47.3	67.5	0.45	0.45
Malawi	9.7	12.1	30.0	15.7	26.2	37.7	0.32	0.41
Mozambique	5.8	19.6	48.0	14.2	34.2	66.8	0.12	0.21
Namibia	8.2	14.3	50.8	29.4	43.4	75.2	0.16	0.39
South Africa	27.8	44.2	81.4	39.9	59.7	87.3	0.34	0.46
Swaziland	52.7	59.2	71.8	69.4	79.3	89.1	0.73	0.78
Tanzania	27.4	56.5	75.6	47.3	67.7	85.2	0.36	0.56
Uganda	25.8	38.2	58.6	26.2	41.7	66.8	0.44	0.39
Zambia	8.5	19.2	42.1	13.6	21.9	44.0	0.20	0.31

Source: Own calculations using SACMEQ in combination with DHS, MICS (for Swaziland) and GHS (for South Africa) data.

poor. This again points to the equity-enhancing nature of the expanded access to schooling in the region since 2000.

4. Extensions

4.1. Access to higher order literacy and numeracy

It is conceivable that an expansion of primary school participation may lead to increased acquisition of basic literacy and numeracy in the population but may adversely affect the acquisition of higher order skills due to a trade-off between quantity and quality. To investigate this, we analyze access to higher order literacy and higher order numeracy, as defined by reaching at least level five out of the eight achievement levels in the SACMEQ test. Level five literacy ("interpretive reading") requires the ability to combine information from various parts of a text and interpret it relative to external or recalled information in order to complete and contextualize meaning (Ross et al., 2005). Level five numeracy ("competent numeracy") requires the ability to solve multiple-operation problems, using whole and mixed numbers as well as the conversion of measurement units from one level to another.

The calculation of access to higher literacy and higher numeracy was the same as that for access-to-literacy and access-to-numeracy. The grade 6 completion rate was multiplied by the proportion of grade 6 students who reached at least level five in SACMEQ. Fig.8 shows access to higher order literacy in 2000 and 2007, and Fig.9 shows the same for access to higher order numeracy. Clearly there are substantial differences in the proportion of students attaining higher-order numeracy and literacy skills. If one looks at the results for 2007 one can see that more than 50% of children in Kenya, Tanzania and Swaziland achieved at least level five in literacy (interpretive reading), compared to less than 20% in Malawi, Zambia, Mozambique and Lesotho.

The general trend is again positive. In most countries there was greater access to higher order literacy and higher order numeracy in 2007 than in 2000. In Lesotho, Namibia, Tanzania and Swaziland there were substantial increases in access to higher order learning. The only decreases were observed for Zambia, Mozambique (numeracy only) and Uganda (numeracy only), but these declines were not statistically significant. Therefore, the period of increased school participation between 2000 and 2007 in Southern and Eastern Africa was generally accompanied by increased access to higher order learning.

4.2. Completion of higher levels of schooling

Lewin (2007) observes that increased primary school access can lead to bottlenecks later in the system if there are binding resource constraints at higher levels of education. Somerset (2007) argues

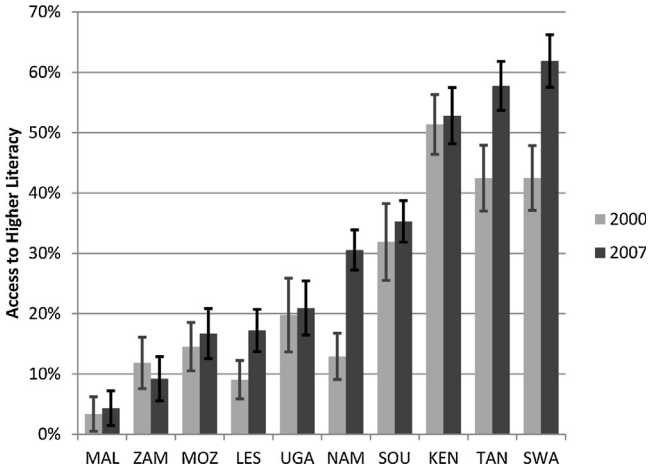

Fig. 8. Access to Higher Literacy in 2000 and 2007.
Source: Own calculations using SACMEQ in combination with DHS, MICS (for Swaziland) and GHS (for South Africa) data.

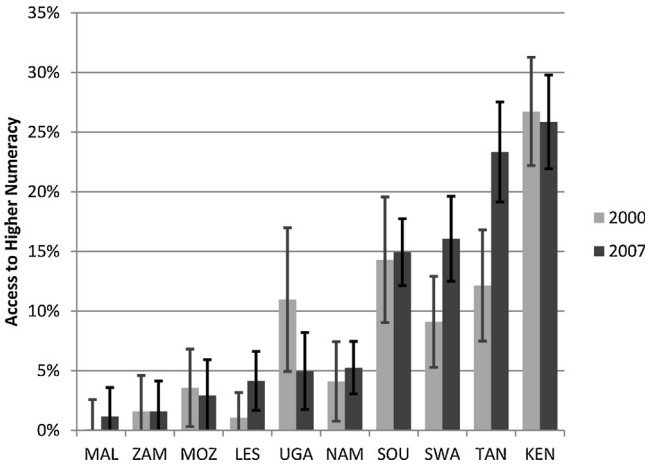

Fig. 9. Access to Higher Numeracy in 2000 and 2007.
Source: Own calculations using SACMEQ in combination with DHS, MICS (for Swaziland) and GHS (for South Africa) data.

that Kenya's abolition of school fees in 1974 led to a massive increase in grade 1 enrolments but a huge increase in drop-out thereafter.

To investigate whether increased access to primary schooling was accompanied by increased throughput to higher levels of schooling, we calculated grade 9 completion rates amongst 22- to 24-year-olds using the same household survey data as for the calculation of grade 6 completion rates. The results are reported in Table 6. In all ten countries, the grade 9 completion rate increased over the period. In Mozambique, Swaziland and Tanzania, where the grade 6 completion rate had increased substantially, the grade 9 completion rate also increased substantially. This would suggest that increased primary school access has also been associated with improved participation in higher levels of education.

4.3. Measuring access to learning using administrative data

The main disadvantage with using grade 6 completion rates obtained from household survey data to calculate access to learning is that there is a lag between the year of grade 6 testing and the year of the household survey and that the magnitude of this lag is slightly different across countries due to limited data availability. Therefore, as a robustness check we employ an alternative method to measure access to literacy and access to numeracy.

The number of grade 6 students achieving basic literacy or basic numeracy can be estimated directly from the SACMEQ data using the raising factor variable ("*rf2*"). This raising factor inflates the total weighted number of students in the sample to be equal to the estimated population of grade 6 students in each country. The SACMEQ project adjusted official school census data estimates of grade 6 enrolments in response to actual enrolments as observed in schools during fieldwork and then used this adjusted sampling frame to re-calculate the probability of selection into the sample and hence the raising factor variable. It is possible to inflate any subgroup within the SACMEQ sample to the estimated population of enrolled grade 6 students for that subgroup. For example, one can calculate and compare the estimated total number of functionally literate grade 6 students in a country in 2000 with that in 2007.

Table 6
Grade 9 completion rates around 2003 and around 2010 (22–24-year-olds).

	Circa 2003	SE	Circa 2010	SE
Kenya	40.1	(1.5)	43.3	(1.9)
Lesotho	37.0	(1.4)	42.2	(1.6)
Malawi	28.8	(1.5)	33.8	(1.1)
Mozambique	8.4	(0.8)	22.5	(1.3)
Namibia	59.0	(2.2)	65.7	(1.3)
South Africa	79.0	(0.7)	83.9	(0.7)
Swaziland	59.6	(2.2)	85.1	(1.6)
Tanzania	10.0	(1.0)	18.1	(1.3)
Uganda	30.6	(1.5)	37.0	(1.5)
Zambia	36.2	(1.7)	41.4	(1.8)

Source: Own calculations using DHS, MICS (for Swaziland) and GHS (for South Africa) data.
Note: Standard errors in parentheses.

Because of population growth, however, it is possible that a country may have had more functionally literate grade 6 students in 2007 than in 2000 even if the proportion of children in the population that were functionally literate declined. To adjust for this, the United Nations (2012) medium variant population estimates for 10- to 14-year-olds were used to calculate an appropriate population growth deflator so as to make the total number of grade 6 students in 2007 comparable with that in 2000. The population growth deflator was multiplied by the total number of functionally literate (numerate) children in 2007 to obtain an adjusted number of grade 6 students reaching basic literacy (numeracy) in 2007. This process is analogous to adjusting for inflation.

The disadvantages of using this alternative method include concerns around the quality and comparability of administrative data on enrolments across countries and time, the need to incorporate population growth estimates, which opens up another possible source of measurement error, and the sensitivity of the method to changing rates of grade repetition. The SACMEQ data indicate that in 2007 there were generally lower rates of grade repetition than in 2000. Since grade repetition leads to a type of "double-counting", declining grade repetition should have a diminishing effect on the number of grade 6 enrolments.

The estimated numbers of functionally literate (and numerate) grade 6 children and the UN medium variant population estimates (as well as the formulas applied to calculate country-specific deflators) are reported in Appendix. Column J in Table A1 (literacy) and Table A2 (numeracy) report the ratio of the number reaching basic literacy (or numeracy) in 2007 to the number reaching basic literacy (or numeracy) in 2000. In all countries, for both literacy and numeracy, the ratios were greater than one, indicating that access-to-learning improved between 2000 and 2007. Although these ratios differ somewhat from those reported in Figs. 3 and 4 (based on household survey data), this sensitivity analysis confirms the broad pattern that access to learning improved over the period of expanded school participation between 2000 and 2007.

4.4. Changes in social composition

The household data analyzed in this paper confirm that children from poor households are less likely to complete grade 6 than more affluent children. Therefore, as access is expanded one would expect the social composition of schools to reflect a larger proportion of children of lower socio-economic status. Table 7 provides an indication of the changing social composition amongst grade 6 students in 2000 and 2007, using mother's educational attainment as a proxy for socio-economic status.

One would generally expect to observe increasing levels of mother's education over time due to historical expansions in access to schooling. However, Table 7 indicates that, in most countries where grade 6 completion rates had increased since 2000, the proportion of grade 6 students whose mother had completed secondary school declined between 2000 and 2007. Therefore, this can be taken to reflect the changing social composition in schools due to increased participation. In some countries the changing social composition according to this measure was substantial (Mozambique, Tanzania, Zambia). In Lesotho and Swaziland, the proportion of students whose mothers had completed secondary school actually increased. This is a bit unexpected given that the grade 6 completion

Table 7
Proportion of mothers with at least complete secondary education.

Country	2000	SE	2007	SE	Percentage increase
Kenya	35.1	(0.02)	30.6	(0.02)	−12.6
Lesotho	19.5	(0.02)	23.5	(0.01)	20.3
Malawi	13.9	(0.02)	10.3	(0.01)	−26.5
Mozambique	13.2	(0.01)	7.6	(0.01)	−42.5
Namibia	34.7	(0.02)	33.5	(0.01)	−3.7
South Africa	42.8	(0.02)	43.0	(0.01)	0.5
Swaziland	31.7	(0.02)	38.6	(0.02)	21.7
Tanzania	17.7	(0.02)	7.3	(0.01)	−58.7
Uganda	21.1	(0.02)	14.9	(0.01)	−29.5
Zambia	31.6	(0.02)	19.5	(0.01)	−38.2

Source: SACMEQ surveys of 2000 ?and 2007.
Note: Standard errors in parentheses.

Table 8
Selected school inputs in 2000 and 2007.

Country	Pupil teacher ratio		Pupils per classroom		Access to reading textbooks		Parent financial contributions		Mathematics teacher content knowledge	
	2000	2007	2000	2007	2000	2007	2000	2007	2000	2007
Kenya	33.4	42.9	47.0	63.5	51.1	39.3	9.0	4.5	968.5	906.1
Lesotho	53.9	41.8	84.2	60.2	71.6	75.4	8.6	3.7	739.4	738.8
Malawi	70.0	88.0	146.9	160.3	71.7	36.6	3.5	4.2	776.0	762.4
Mozambique	51.3	58.0	158.0	190.0	73.4	66.9	2.7	2.5	782.8	745.6
Namibia	31.5	31.1	50.8	40.2	76.7	63.3	4.0	4.9	734.8	771.1
South Africa	36.5	34.3	47.2	50.5	66.3	73.2	5.1	4.5		763.6
Swaziland	35.1	34.2	40.9	41.8	90.1	99.4	8.9	8.4	808.1	811.1
Tanzania	47.1	62.9	96.3	100.2	15.9	13.2	5.7	4.1	794.3	825.8
Uganda	58.0	55.7	132.7	114.1	26.6	32.0	4.2	4.4	822.9	833.3
Zambia	53.7	74.5	81.1	97.9	41.8	43.5	6.3	4.8	759.1	740.4

Source: SACMEQ surveys of 2000 ?and 2007.
Note: South African teachers were not tested in 2000.

rate increased over the period, but it may reflect sizable historical increases in secondary school completion.

The changing social composition is likely to have had a direct negative effect on country average test scores since poorer children tend to achieve lower test scores. However, there may also have been an indirect effect of the changing social composition through peer effects – students in 2007 perform worse than similar children in 2000 because of a weaker peer group.[11]

4.5. School resources

One of the main reasons why one might expect a trade-off between access and school performance is the stretch on resources as more students enter the system. Table 8 describes the state of selected school inputs in 2000 and in 2007. Pupil–teacher ratios increased in most of the countries in which substantial expansions occurred (Kenya, Malawi, Mozambique, Tanzania and Zambia). The same countries also experienced increases in the ratio of pupils to physical classrooms. There was no clear pattern with respect to changes in access to reading textbooks, with some countries improving access to textbooks and others going backwards.[12] In no countries were there substantial increases in parent financial contributions and in some countries there were noticeable declines (Kenya, Lesotho, Tanzania and Zambia).[13] This is what one might expect to observe in a context of fee abolitions and increasing participation of children with parents of low socio-economic status. Apart from the effect on school budgets and resources, declining parental contributions may be expected to reduce local accountability. Teacher content knowledge, as measured by detailed tests taken by grade 6 teachers, declined on average in Kenya (although Kenya remained the top-performer on this measure), Mozambique and Zambia, and increased in Namibia, Tanzania and Uganda.

Any strong conclusions about what successful countries did to manage expansions in access without large quality deteriorations based on only ten countries would be tenuous. However, there are one or two broad points worth noting from Table 8. In Kenya and Tanzania – two of the top-performing countries in the sample and both having experienced increases in grade 6 completion – pupil–teacher ratios and pupil-to-classroom ratios increased considerably but the quality of teachers, as measured by content knowledge, remained at a high level compared with other countries. This is consistent with Mingat's (1998) argument that Asian countries that successfully managed to expand access and quality placed more emphasis on teacher quality (as reflected in teacher remuneration) than on pupil–teacher ratios. These observations are also consistent with one of the main findings from the education production function literature,

[11] In most countries, children in SACMEQ (2007) performed as well or better than children in SACMEQ 2000 who had the same level of mother's education. Only in Mozambique did children perform worse in 2007 for the same observed mother's education. This is in line with Crouch's (2011) conclusion that changes in social composition cannot fully explain Mozambique's decline in average achievement. However, changes in social composition would include not only changes in observable characteristics but also in unobservable characteristics. It is therefore not possible to identify truly comparable groups of children in 2000 and 2007, which would be necessary for an estimate of the causal impact of the educational expansions on individuals.

[12] Good access to textbooks was defined as either each child has a textbook or children share a textbook with at most one other child.

[13] A summative index was generated based on 14 questions in the school principal questionnaires about whether parents contribute in various ways, including helping with building maintenance, purchasing of stationary and paying examination fees, inter alia.

namely that additional resources are no guarantee of better outcomes, but rather that aspects of teacher quality, teacher motivation and school management are likely to be the important drivers of school performance (Van der Berg, 2008; Hanushek, 2003).

5. Conclusion

Viewing country average test scores or enrolment rates in isolation is misleading, particularly when evaluating trends over time. In order to meaningfully assess education system performance in countries with incomplete (or changing) access to education it is imperative to use a combined measure of access and quality. In this paper we argued that education system performance should be re-conceptualized and measured as the amount of learning that takes place in the overall population of children (those enrolled and those not enrolled).

Using a new measure of "access to learning" – the proportion of children who reach a particular grade and have acquired specific learning outcomes – this paper has shown that the expansion of access to primary schooling in Southern and Eastern Africa since 2000 was accompanied by improved access to literacy and numeracy in these countries. Girls and children from poor households benefited most from this improvement in access to learning. Not only did access to basic literacy and numeracy improve, but so did access to higher order literacy and numeracy learning. The improvements in access to learning at the grade 6 level were also accompanied by increased attainment of higher levels of schooling, as measured by grade 9 completion rates. The results are robust to an alternative method for measuring access to learning that uses administrative data on school enrolments rather than household survey data.

The analysis presented here illustrates the general principle that a downward shift in the distribution of test scores (amongst those enrolled) can be completely congruent with improved access to learning (in the overall population). Having noted this, there may well be merit in retaining some focus on the average quality of achievement within particular schools. The new measure proposed in this paper should therefore be seen as a complement to existing measures of quality rather than as a substitute.

The main contribution of this analysis is limited to describing access to learning between 2000 and 2007. The paper does not separate out the "value-added" by teachers and schools from the influence of the social composition of schools; nor does it measure the causal effect of increased school participation on children who would otherwise have been enrolled in the absence of an expansion.

As countries approach universal primary education, similar measurement challenges may emerge around the expansion of access to secondary education. This paper has shown that declining average performance indicators are not necessarily to be feared if improved access to learning in the entire population is achieved.

Despite these large gains through expanded access, the key challenge going forward is to improve the quality of schooling in these countries. Most education systems in Southern and Eastern Africa are performing far below developed country standards and some perform significantly worse than similar developing countries. Raising the quality of primary schooling in these countries may now be the most important component in improving access to secondary and tertiary education, and consequently, improving the economic prospects of these countries.

By describing what actually happened in Southern and Eastern Africa between 2000 and 2007, this paper has shown that the substantial expansions of access to primary education since 2000 did not reduce education system effectiveness, when properly defined, but rather facilitated a greater proportion of children enjoying access to learning.

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Appendix

Tables A1 and A2

Table A1
Calculating the population growth-adjusted ratios of functional literacy in 2007 to functional literacy in 2000.

	A	B	C	D	E	F	G	H	I	J
	Number of grade 6 children Flit in 2000	Number of grade 6 children Flit in 2007	Population of 10–14 year-olds in 2000	Population of 10–14 year-olds in 2005	Population of 10–14 year-olds in 2010	Annual population growth rate (2005–2010)	Calculated estimate of 2007 population	Population Deflator (τ)	Deflated Number of grade 6 children Flit in 2007	Population growth adjusted ratio of Flit2007: Flit2000
Kenya	549,857	685,722	4,283,000	4,387,000	4,821,000	0.0190	4,555,703	0.064	642,061	1.17
Lesotho	27,425	35,554	256,000	265,000	270,000	0.0037	266,989	0.043	34,028	1.24
Malawi	88,395	122,846	1,400,000	1,688,000	1,914,000	0.0254	1,775,008	0.268	89,940	1.02
Mozambique	114,805	250,581	2,218,000	2,523,000	2,918,000	0.0295	2,674,142	0.206	199,048	1.73
Namibia	27,360	41,674	230,000	258,000	268,000	0.0076	261,954	0.139	35,884	1.31
South Africa	622,080	675,350	5,021,000	4,979,000	4,963,000	−0.0006	4,972,594	−0.010	681,861	1.10
Swaziland	24,593	27,639	158,000	156,000	149,000	−0.0091	153,161	−0.031	28,486	1.16
Tanzania	450,163	931,624	4,345,000	4,831,000	5,467,000	0.0250	5,076,003	0.168	774,888	1.72
Uganda	246,078	487,165	3,181,000	3,752,000	4,392,000	0.0320	3,995,974	0.256	362,353	1.47
Zambia	85,465	135,219	1,283,000	1,436,000	1,688,000	0.0329	1,531,940	0.194	108,982	1.28
Source	SACMEQ 2	SACMEQ 3	UN	UN	UN	–	–	–	–	–
Formula	–	–	–	–	–	$F_i = \left(\frac{E_i}{D_i}\right)^{0.2} - 1$	$G_i = D_i(1+F_i)^2$	$H_i = \frac{G_i - C_i}{C_i}$	$I_i = B_i - B_i \cdot H_i$	$I_i = \frac{I_i}{A_i} = \frac{\tau \sum LIT_{i,t+1}}{\sum LIT_{i,t}}$

Note: The source of population growth rates was the United Nations Medium Variant Population Estimates. The letters in the formulas refer to the columns. Flit stands for functionally literate.

Table A2
Calculating the population growth-adjusted ratios of functional numeracy in 2007 to functional numeracy in 2000.

	A	B	C	D	E	F	G	H	I	J
	Number of grade 6 children Fnum in 2000	Number of grade 6 children Fnum in 2007	Population of 10–14 year-olds in 2000	Population of 10–14 year-olds in 2005	Population of 10–14 year-olds in 2010	Annual population growth rate (2005–2010)	Calculated estimate of 2007 population	Population Deflator (τ)	Deflated Number of grade 6 children Fnum in 2007	Population growth adjusted ratio of Fnum2007: Fnum2000
Kenya	520,192	662,040	4,283,000	4,387,000	4,821,000	0.0190	4,555,703	0.064	619,887	1.19
Lesotho	13,325	26,259	256,000	265,000	270,000	0.0037	266,989	0.043	25,131	1.89
Malawi	41,495	77,816	1,400,000	1,688,000	1,914,000	0.0254	1,775,008	0.268	56,972	1.37
Mozambique	106,735	215,352	2,218,000	2,523,000	2,918,000	0.0295	2,674,142	0.206	171,064	1.60
Namibia	11,744	25,242	230,000	258,000	268,000	0.0076	261,954	0.139	21,735	1.85
South Africa	437,075	556,346	5,021,000	4,979,000	4,963,000	−0.0006	4,972,594	−0.010	561,710	1.29
Swaziland	19,565	25,646	158,000	156,000	149,000	−0.0091	153,161	−0.031	26,431	1.35
Tanzania	366,154	837,643	4,345,000	4,831,000	5,467,000	0.0250	5,076,003	0.168	696,718	1.90
Uganda	203,222	375,081	3,181,000	3,752,000	4,392,000	0.0320	3,995,974	0.256	278,985	1.37
Zambia	47,870	79,704	1,283,000	1,436,000	1,688,000	0.0329	1,531,940	0.194	64,239	1.34
Source	SACMEQ 2	SACMEQ 3	UN	UN	UN	–	–	–	–	–
Formula	–	–	–	–	–	$F_i = \left(\frac{E_i}{D_i}\right)^{0.2} - 1$	$G_i = D_i(1+F_i)^2$	$H_i = \frac{G_i - C_i}{C_i}$	$I_i = B_i - B_i \cdot H_i$	$I_i = \frac{I_i}{A_i} = \frac{\tau \sum NUM_{i,t+1}}{\sum NUM_{i,t}}$

Note: The source of population growth rates was the United Nations Medium Variant Population Estimates. The letters in the formulas refer to the columns. Fnum stands for functionally numerate.

Appendix B. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.ijedudev.2014.12.001.

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