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The effects of rapidly expanding primary school access on effective learning: The case of Southern and Eastern Africa since 2000[1]

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ABSTRACT

Have recent expansions of access to primary schooling in African countries led to deterioration in the quality of education delivered? This paper helps clarify this question by presenting an appropriate conceptual framework: instead of considering country average test scores and enrolment rates in isolation, we argue that the important outcome of interest is the proportion of children in an age-specific population that reach particular levels of literacy and numeracy. In order to measure this outcome we combine school achievement data with enrolment data for a selection of 14 Southern and Eastern African education systems. Using this preferred measure, we examine the performance of these education systems between 2000 and 2007, many of which considerably increased access to primary schooling in this period. The commonly held perception of an access-quality trade-off in Africa has far less empirical support than was previously believed to be the case.

Keywords: Enrolment, School quality, Human capital, Southern and Eastern Africa, SACMEQ, Education Statistics
JEL codes: I21, I25, I28, O15

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1. INTRODUCTION

Sub-Saharan Africa continues to lag behind the rest of the developing world in providing access to primary school education (Easterly, 2009; Majgaard and Mingat, 2012). Nevertheless, the various drives towards universal primary education, first in the 1960s and 1970s and more recently given momentum through the Millennium Development Goals, have led to a considerable improvement in access to schooling in many African countries.

This is particularly true of Southern and Eastern Africa, which is the focus of this paper. In some countries, notably Kenya and Tanzania, national campaigns to improve primary school access in the 1970s were followed by declining enrolments in the 1980s (Sifuna, 2007: 693). Since the late 1990s there has been a renewed wave of expansion. This again involved national campaigns and the abolition or re-abolition of fees, for example Malawi in 1994, Uganda in 1997, Tanzania in 2001 and Kenya in 2003 (Chimombo *et al*, 2005: 16; Zuze and Leibbrandt, 2011: 170; Hardman *et al*, 2012: 826; Dubeck *et al*, 2012: 52). In other countries, such as Mozambique and Zambia, the end of civil war or periods of economic decline led to fairly sudden and rapid expansions in school participation.

Meanwhile, the rise of international surveys of educational achievement such as PISA, TIMSS, PIRLS and SACMEQ, has led to a burgeoning literature focussing on the quality of schooling across countries, as measured by country average test scores.[3] The dismal performance of African countries in these assessments has led many critics to argue that schooling which fails to produce learning is of limited value (for example, Lewin, 2009; Pritchett, forthcoming). Moreover, economists such as Hanushek and Woessman (2007) have shown that the quality of education (as proxied by test scores) is more important than merely the quantity of education (as measured by years of schooling) 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 becoming familiar, and rightly so.

However, in much of the current literature there is often an implicit or explicit notion that increased access has contributed to deterioration in the effectiveness of Sub-Saharan education systems to produce learning. In other words, there is a perception of a trade-off between access and quality. For example, Colclough, Kingdon and Patrinos (2009: 2) 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: 16) maintain that "the introduction of Free Primary Education [in Malawi] in 1994 seems to have worsened the situation. Consequently, the quality of the education being offered has greatly deteriorated." In view of the low quality of education observed in Uganda, Zuze and Leibbrandt (2011) suggest that perhaps the expansion should have been phased in more slowly so as to allow better planning and preparation. Similarly, Crouch and Vinjevold (2006) argue that while most countries manage to improve both access and quality, the region of Southern Africa is unique in that many countries have over-emphasized "access at the expense of learning" (Crouch

[3] 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.

and Vinjevold, 2006: 8), thus creating an imbalance between access and quality and demonstrating that "the tension between access and quality is real" (Crouch and Vinjevold, 2006: 1).

To a large extent, the confusion around the relationship between access and 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 in international surveys. Consequently, the literature generally conceptualises declining education quality as a declining average level of performance amongst those enrolled, although this conceptualisation is usually implicit and vague. Rather, this paper proposes that a decline in education system quality should be conceptualised as a decline in the proportion of age-specific population cohorts achieving certain threshold levels of educational performance.

Moreover, treating access and quality (as measured by test scores) separately can be deceptive. Measures of access that ignore education quality present a distorted view – for example, South Africa and Mauritius have similar primary school completion rates but perform very differently in terms of grade 6 reading and mathematics achievement. Conversely, country average test scores will suffer from a selection bias whenever there are significant proportions of non-enrolled children. As Lambin (1995: 174) points out, "the smaller the proportion of an age group participating in the study, the better the average performance of those who are taking the test." This is the case because those not enrolled tend to be from poorer home backgrounds in terms of socio-economic status and parental education than those who do attend school. Therefore, an influx of children from lower socio-economic backgrounds causing a decline in a country's average test score does not necessarily mean that the quality of schools declined.

This paper develops meaningful measures of education system performance that combine both access and quality and then examines system performance since 2000 in 14 Southern and Eastern African education systems. Section 2 introduces the relevant data on enrolment rates and school performance. Section 3 explains the methodology according to which education system performance is defined and measured for the purposes of this paper. This section proposes a conceptual model of the production of human capital in order to be clear about the various channels through which access to education and the efficiency of school institutions influence the production of human capital. Two methods for measuring human capital production using available data are then explained. Section 4 presents the results of what happened to human capital production in countries that expanded access to primary school education since 2000. Section 5 provides further analysis and discussion around the significance of these findings. Section 6 concludes.

2. DATA

The paper focuses on the 14 education systems in Southern and Eastern Africa that participated in both the last two rounds of the SACMEQ project (in 2000 and 2007)[4]. The Southern and Eastern African Consortium for Monitoring Educational Quality (SACMEQ) is a collaborative network of 15 ministries of education in Africa that periodically conducts standardised surveys to assess the quality

[4] In this paper "SACMEQ 2000" is used interchangeably with "SACMEQ 2" since this was the second round of SACMEQ. Similarly, "SACMEQ 2007" is used interchangeably with "SACMEQ 3".

of education in Southern and Eastern Africa, and aims to enhance evidence-based policy and research on the continent. The SACMEQ coordinating centre is located in UNESCO's International Institute for Educational Planning (IIEP). The 14 education systems in this study are: Botswana, Kenya, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Uganda, Zambia and Zanzibar. Note that Zanzibar, though part of Tanzania, participated in SACMEQ as a separately analysed education system. Zimbabwe participated in 2007 but not in 2000 and is excluded from the present analysis.

We obtain enrolment data for these countries from the Demographic and Health Surveys (DHS), which are widely used in research comparing social outcomes across developing countries. Filmer (2010) has compiled a database containing DHS data, or strictly comparable data from other household surveys, for numerous countries in various years. There are several benefits to using this data rather than traditional Gross Enrolment Ratios (GER) or Net Enrolment Ratios (NER).[5]

Firstly, 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 these two sources of information happen to be biased in opposite directions the error in the calculated GER or NER will be compounded. In contrast, when using household survey data age-specific enrolment or school attendance rates are taken from a single source of data.

Secondly, while the methodologies employed by ministries of education and national statistics offices vary considerably across countries, the DHS surveys have followed a fairly uniform methodology across countries and over time. Therefore, age-specific enrolment rates from DHS data present a more valid basis for comparison across countries and time than do traditional GERs and NERs.

Thirdly, 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 push up the GER because there will be more children enrolled in school while the size of the age-appropriate population will remain the same.

Fourthly, and perhaps due to the reasons above, GERs and NERs reported in the EFA Global Monitoring Reports are often at odds with what experts know to be the reality in specific countries. For example, the Primary NERs reported in the 2011 EFA Global Monitoring Report (UNESCO, 2011: 343-344) suggest that some very poor countries (e.g. Zambia-95%, Uganda-97%, Tanzania-99% and Malawi-91%) have higher rates of enrolment than many of the wealthier countries (e.g. Botswana-87%, South Africa-87%, Namibia-89%).

The age-specific enrolment rates reported in Table 1 present a far more meaningful picture of access to education across Southern and Eastern Africa, and of how this has changed since 2000. These

[5] 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.

were calculated for the age group in the DHS corresponding to the median age of the grade 6 students in the SACMEQ samples, which ranged between 12 and 14 years.[6] The age-specific enrolment rates in 2007 varied from 74% in Mozambique to 99% in South Africa. Enrolment increased in all countries between 2000 and 2007, with especially large expansions in Mozambique, Zambia and Tanzania.

Table 1: *Enrolment rates amongst grade 6-aged children according to comparable household survey data*

	Enrolment rate in 2000	Enrolment rate in 2007
Kenya	0.89	0.95[f]
Lesotho	0.79	0.89[g]
Malawi	0.79	0.86[d]
Mozambique	0.57[a]	0.74[c]
Namibia	0.90	0.93
South Africa	0.97[b]	0.99[d]
Swaziland	0.87	0.93[e]
Tanzania	0.74	0.85
Uganda	0.88	0.89[e]
Zambia	0.75[b]	0.91
Zimbabwe	-	0.92[e]

Notes: The enrolment rates correspond to the median age of grade 6 students in each country at the time.

[a] Data only available for 1997; [b] Data only available for 1999; [c] Data only available for 2003; [d] Data only available for 2005; [e] Data only available for 2006; [f] Data only available for 2008; [g] Data only available for 2009.

There are no available DHS data for Botswana, Mauritius and Seychelles.

Source: Various Demographic and Health Surveys (DHS), Multiple Indicator Cluster Surveys (MICS) and General Household Surveys (GHS) taken from Filmer (2010).

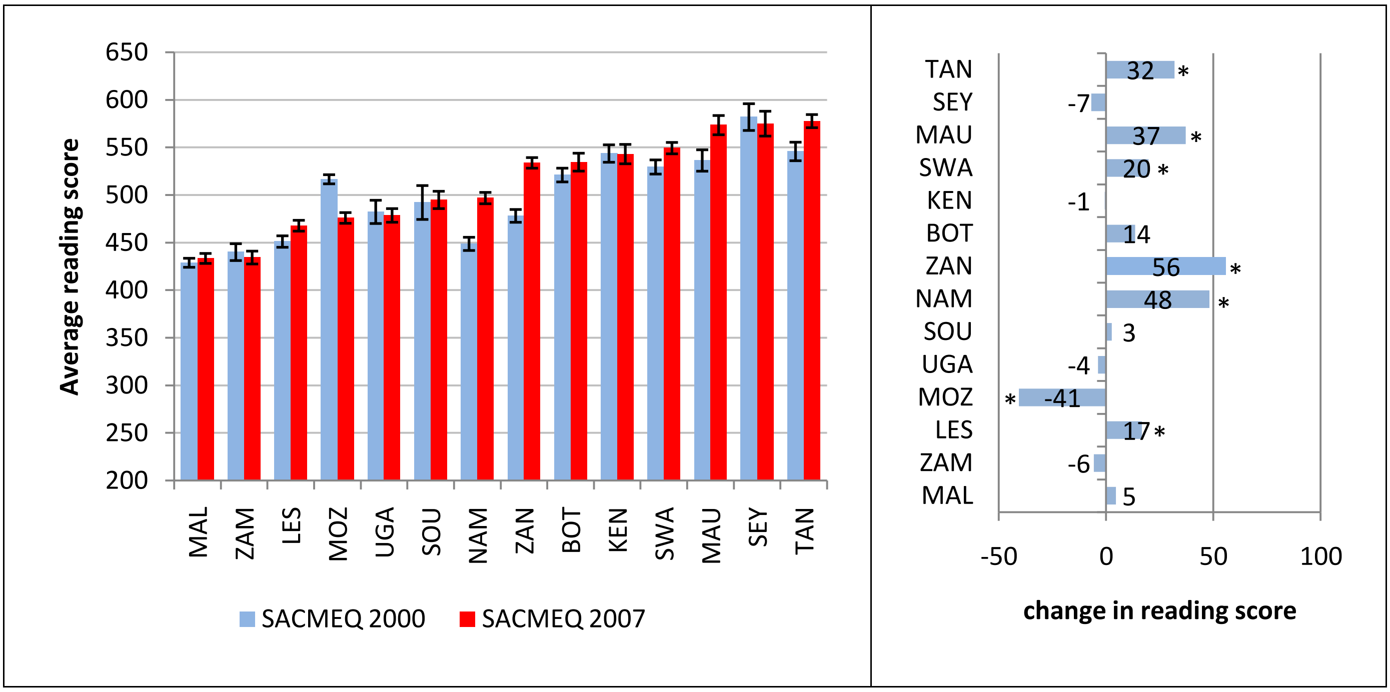
We obtain educational achievement data from the 2000 and 2007 rounds of the SACMEQ project. This project tested reading and mathematics achievement amongst grade 6 students and collected extensive background information about the students as well as their schools and teachers. The SACMEQ datasets contain the most reliable and comprehensive information available on education system performance in Southern and Eastern Africa. In 2000, SACMEQ tested 41686 students in 2294 schools across 14 education systems (treating Tanzania and Zanzibar as separate systems). In 2007, with the addition of Zimbabwe, SACMEQ tested 61396 students in 2779 schools across 15 education systems. In addition to educational achievement data, the SACMEQ datasets also contain

[6] In SACMEQ 2000 the median age was 12 in South Africa, 13 in Kenya, Namibia, Swaziland and Zambia, 14 in Lesotho, Malawi, Mozambique and Uganda, and 15 in Tanzania. However, for Tanzania the enrolment rate for 14 year-olds was used, as this information was unavailable for 15 year-olds. In SACMEQ 2007 the median age was 12 in South Africa and Zimbabwe, 13 in Kenya, Lesotho, Mozambique, Namibia, Swaziland and Zambia, and 14 in Malawi, Tanzania and Uganda.

a raising factor variable which inflates the sample to the estimated size of the grade 6 population, thus providing an alternative measure of the number of enrolments in both 2000 and 2007.

Figures 1 and 2 show the country average reading and mathematics scores for all 14 education systems in SACMEQ 2000 and 2007.[7] 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. The 2007 scores were then calculated on the same scale as the 2000 scores so as to ensure comparability. 95% confidence intervals are also indicated in the figures. Zambia and Malawi had the worst-performing grade 6 students on average. In 2007, Tanzania had the highest-performing grade 6 students in reading while Mauritius had the highest-performing students in mathematics. The right-hand pane in Figures 1 and 2 show the change in the average score. Clearly most countries improved their average scores in both reading and mathematics between 2000 and 2007, especially in the cases of Namibia, Mauritius, Tanzania and Zanzibar. On the other hand, reading and mathematics achievement declined in Mozambique and mathematics achievement declined in Uganda.

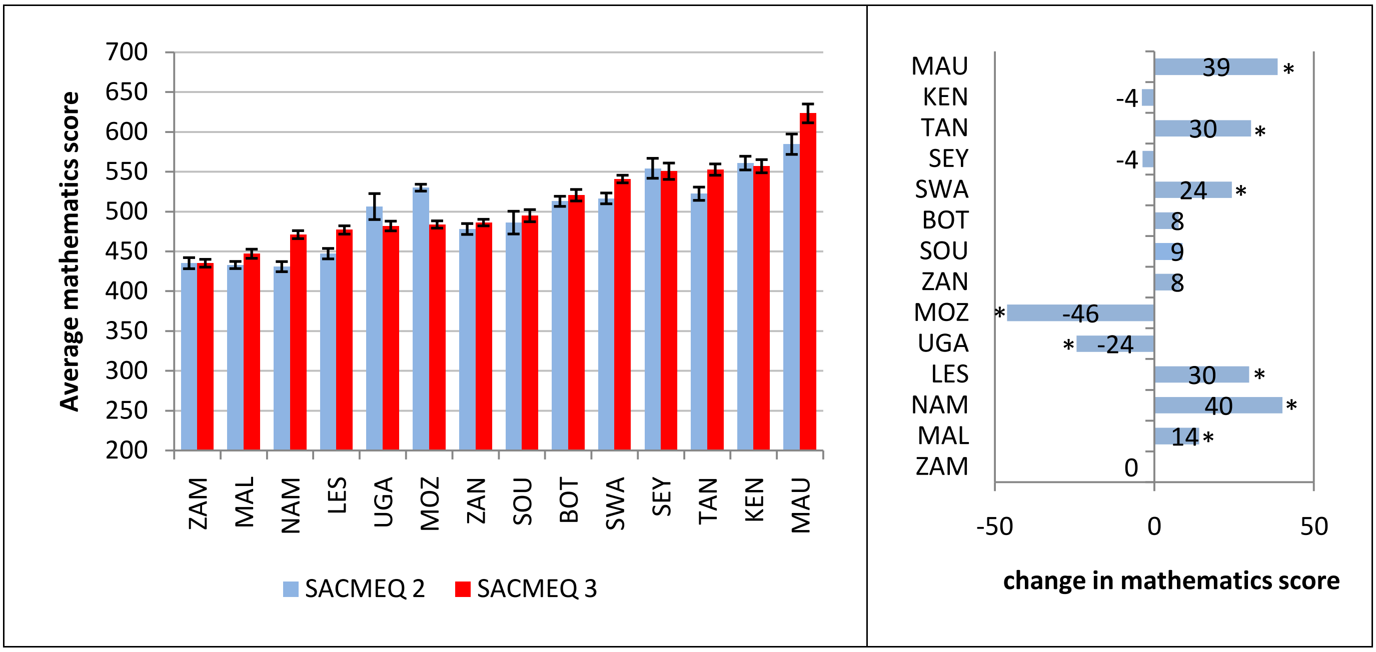
Figure 1: *Reading achievement in SACMEQ 2 and 3 by country*



Note: A star signifies that the change was significantly different from zero (p<0.95)

[7] In all calculations involving SACMEQ data the appropriate adjustments for complex sampling and weighting were made.

Figure 2: *Mathematics achievement in SACMEQ 2 and 3 by country*



Note: A star signifies that the change was significantly different from zero (p<0.95)

Educational experts have categorised scores in the SACMEQ 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. The eight competency levels for literacy and numeracy are described in Appendix A, and in even more detail by Hungi *et al* (2010). According to this categorisation, children failing to reach level 3 in either reading ('basic reading') or mathematics ('basic numeracy') can be regarded as functionally illiterate and functionally innumerate respectively. According to Ross *et al* (2005: 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. This competency threshold has also been used by Shabalala (2005: 222) who deems students achieving at levels 1 and 2 in SACMEQ "non-readers" and "non-numerate".

Table 2 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 (55.9%) and functionally numerate (33.0%). 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 points to a relatively equitable school system that is successful in providing basic skills to the vast majority of students. Namibia recorded the greatest improvement in the proportions of children reaching functional literacy and numeracy since 2000. In contrast the proportions of students reaching functional literacy and numeracy declined substantially in Mozambique, and somewhat in Uganda in the case of numeracy.

Table 2: *Proportions of grade 6 children functionally literate and numerate in 2000 and 2007 by country*

	Percentage Functionally literate		Percentage Functionally numerate	
	2000	2007	2000	2007
Botswana	91.6	89.4	75.4	77.5
Kenya	95.4	92.0	91.4	88.8
Lesotho	75.7	78.8	41.1	58.2
Malawi	61.5	63.4	33.9	40.2
Mauritius	83.4	88.9	83.2	88.8
Mozambique	94.6	78.5	90.3	67.5
Namibia	62.6	86.4	29.1	52.3
Seychelles	91.4	88.3	80.6	82.2
South Africa	72.8	72.7	53.6	59.9
Swaziland	98.7	98.5	83.4	91.4
Tanzania	92.7	96.5	79.3	86.8
Uganda	78.1	79.6	66.4	61.3
Zambia	56.1	55.9	36.5	33.0
Zanzibar	82.7	90.8	64.5	66.6

Source: Own calculations based on SACMEQ data from 2000 and 2007

When one considers the enrolment trends (Table 1) in combination with the educational achievement trends (Figures 1 and 2 and Table 2) 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 age-specific enrolment ratio amongst the countries in Table 1 but a relatively large proportion of functionally illiterate and innumerate grade 6 students. In contrast, a very high proportion of Tanzanian grade 6 students reach functional literacy and numeracy but a considerable proportion of the population remains outside the school system. Moreover, there is ambiguity regarding educational development in a case such as Mozambique where access to primary schooling increased impressively but the country average score (and proportion of enrolled students reaching basic skills) declined.

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 recognises 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: 85). The EFA report, however, still uses separate measures of access and quality and therefore remains ambiguous about the cases of Mozambique and Uganda. The next section outlines a conceptual framework and methodology which allows for a more holistic approach to analysing education system performance overtime.

3. METHODOLOGY

a) Conceptual framework

Confusion around the perceived trade-off between access and quality stems largely from a lack of definitional clarity and a failure to appreciate that country average test scores reflect only the performance of those children attending school. In order to help reduce confusion, we propose that the salient goal for an education system is to produce a higher proportion of the overall school-aged population achieving at a particular level of performance.[8] One can regard the number of children within a particular cohort, say the grade 6-aged population in a country, reaching a certain basic level of literacy or numeracy as an indicator of the accumulation of human capital being realised by the school system. Equation (1) describes how this accumulation of human capital in country *i* at time t ($HC_{i,t}$) is the product of the number of children enrolled in grade 6 ($N_{i,t}$) and the quality of school institutions ($Q_{i,t}$) as defined by the proportion of grade 6 students that achieve a certain basic level of literacy or numeracy.[9]

$$HC_{i,t} = N_{i,t}.Q_{i,t} \qquad (1)$$

The number of children enrolled in grade 6 ($N_{i,t}$) is in turn a function of the size of the grade 6 aged population ($POP_{i,t}$), purposive policies to encourage school attendance ($Policy_{i,t}$) such as the EFA drive, the abolition of school fees or raising the legal age of marriage, and the demand for schooling ($D_{i,t}$).

$$N_{i,t} = f(POP_{i,t}; Policy_{i,t;}D_{i,t}) \qquad (2)$$

The demand for schooling is influenced by household income, proxied by GDP *per capita* ($GDPpc_{i,t}$), and by expectations about the pecuniary returns to education ($E_{i,t}$). Note also that while some aspects of the policy environment affect the supply of schooling, other policies influence the demand for schooling, such as a change in the legal age of marriage.

$$D_{i,t} = f(GDPpc_{i,t}; E_{i,t}) \qquad (3)$$

Meanwhile, the quality of schools ($Q_{i,t}$), defined as the proportion of students achieving a basic threshold of literacy or numeracy, is determined by available resources per student ($R_{i,t}$), policy interventions that are not based on increasing resources ($I_{i,t}$) - such as achieving a more efficient mix of resources, introducing a different curriculum or improving the incentives facing teachers - and

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

[9] One caveat to this equation pertains to grade repetition. A high prevalence of grade repetition would serve to artificially increase the number of children enrolled in grade 6. The purpose of this paper is however to compare the production of human capital in 2000 and 2007. According to the SACMEQ data, grade repetition declined slightly in most countries over this period. Therefore, if anything, the bias introduced by grade repetition would serve to slightly underestimate any improvement in human capital between 2000 and 2007.

the mean socio-economic status of those attending school ($SES_{i,t}$).Equation (4) thus asserts that more resources per student, better education policies and a more affluent social composition within schools will improve the ability of schools to produce literate and numerate students.

$$Q_{i,t} = f(R_{i,t}; I_{i,t}; SES_{i,t}) \quad (4)$$

Resources per student is the product of GDP ($GDP_{i,t}$), the tax rate ($T_{i,t}$), the proportion of overall government expenditure that is spent on school education ($EdSp_{i,t}$) and the internal efficiency of the national ministry of education to translate tax dollars into on-the-ground resources for children ($Eff_{i,t}$), all divided by the number of students enrolled ($N_{i,t}$).

$$R_{i,t} = \frac{GDP_{i,t}.T_{i,t}.EdSp_{i,t}.Eff_{i,t}}{N_{i,t}} \quad (5)$$

The mean socio-economic status of those attending school ($SES_{i,t}$) is a function of GDP *per capita* ($GDPpc_{i,t}$) and the number of students enrolled ($N_{i,t}$), because as access is expanded those entering the school system are typically poorer than those already enrolled, thus bringing down the mean socio-economic status.

$$SES_{i,t} = f(GDPpc_{i,t}; N_{i,t}) \quad (6)$$

Several points follow from the above set of equations. Firstly, increased access to schooling indicated by an increase in $N_{i,t}$ affects the production of human capital ($HC_{i,t}$) positively and directly through Equation (1). In fact, and most obviously, the effectiveness of the school system in producing literate and numerate individuals depends in the first place on children attending school. Access is clearly a necessary condition for learning. Secondly, increased access to schooling affects human capital production negatively and indirectly as the stretch on resources per student (seen in Equation (5)) and less favourable social composition (seen in Equation (6)) negatively impacts on the ability of schools to produce literate and numerate individuals amongst those attending school (as seen in Equation (4)). In this sense, assuming social composition and resources per student do indeed influence school quality and holding other factors such as absolute education expenditure and the efficiency of spending constant, such a trade-off between $N_{i,t}$ and $Q_{i,t}$ is a mathematical certainty. Therefore, if $N_{i,t}$ increases and $Q_{i,t}$ declines it remains ambiguous and ultimately an empirical question whether or not an expansion will lead to greater production of human capital.

Thirdly, this set of equations shows that it is possible for an expansion to occur with no deterioration in $Q_{i,t}$. This is because the stretch on resources and the social composition effects of an expansion could be more than offset by economic growth, smart policy interventions and a greater prioritization of education spending.

Fourthly, GDP *per capita* influences the production of human capital at various stages. Firstly, it influences the demand for schooling ($D_{i,t}$) and hence partly determines access; as households become more wealthy they tend to place greater value on education. Secondly, it influences the quality of schools ($Q_{i,t}$) through availing resources and through affecting the social composition of schools ($SES_{i,t}$). This introduces an element of endogeneity to the issue of whether increased access causes increased human capital production in that economic growth could be simultaneously determining both access and quality. In this paper we are not able to neatly demonstrate the causal impact of increased access on the production of human capital because, i) we are not able to observe all the relevant components in the above equations, ii) we do not know of any exogenous event that caused some countries to expand faster than others and could therefore serve as an instrumental variable, and iii) we only have 14 observations. However, we clarify what did happen to the production of human capital in Southern and Eastern African countries that expanded access to primary education since 2000 and we present an argument that what happened cannot merely be attributed to economic growth alone.

b) Estimation Method 1

We now apply two methods of estimating how the production of human capital changed between 2000 and 2007 in the 14 school systems in Southern and Eastern Africa. The first method compares the number of children reaching functional literacy (and numeracy) in 2007 to that in 2000, after adjusting for population growth. To illustrate this method consider that the total grade 6-aged population in country *i* at time *t* ($POP_{i,t}$) consists of the total number of functionally literate grade 6 students ($LIT_{i,t}$), the total number of functionally illiterate grade 6 students ($ILIT\_enr_{i,t}$) and the total number of grade 6-aged children that are not enrolled in school ($UNENR_{i,t}$).

$$POP_{i,t} = LIT_{i,t} + ILIT\_enr_{i,t} + UNENR_{i,t} \qquad (7)$$

We then make the key assumption that those children who are not enrolled and whose age is the same as the median age amongst the grade 6 cohort in that country can be deemed functionally illiterate (and innumerate). We base this decision on several grounds. Firstly, it is highly unlikely that those who never enrolled in the school system at all would somehow have attained functional literacy and numeracy. Secondly, amongst those who did enrol only to drop out before grade 6, it is likely that either low socio-economic status or weak performance (perhaps accompanied by multiple repetition), or a combination of these, would have caused them to drop out. It is unlikely that a significant proportion of those dropping out due to weak performance would have reached a higher level of skill prior to grade 6 than the many students who did progress to grade 6 and yet had not yet reached functional literacy or numeracy. Given that socio-economic status is strongly correlated with achievement amongst those enrolled in grade 6 it is probable that those who previously dropped out for reasons related to their socio-economic background 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 14% of 14-year olds in Malawi who were not enrolled would have been a better-performing group than the 60% of grade 6 students in Malawi who were enrolled but were still functionally innumerate. Indeed, the DHS data confirm that age-specific enrolment rates are lower amongst children from poorer socio-economic backgrounds in the countries considered in this analysis (Filmer, 2010). Finally, even if it were the case that a small proportion of non-enrolled children 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 remains appropriate to group them with those observed to be functionally illiterate and innumerate.

This means that equation (7) can be reduced by grouping those not enrolled with those enrolled but functionally illiterate, as follows:

$$POP_{i,t} = LIT_{i,t} + ILIT\_tot_{i,t} \tag{8}$$

If one multiplies the total population of grade 6-aged children in year *t+1* by an appropriate population growth deflator (τ) to adjust for the growth (or shrinkage) in the age-specific population between time *t* and *t+1*, this number will equal the total population of grade 6-aged children in time *t*:

$$POP_{i,t} = \tau(POP_{i,t+1}) \tag{9}$$

Substituting equation (8) into equation (9) gives:

$$LIT_{i,t} + ILIT\_tot_{i,t} = \tau\left(LIT_{i,t+1} + ILIT_{i,t+1}\right) \tag{10}$$

Therefore, if

$$\tau. LIT_{i,t+1} > LIT_{i,t}, \tag{11}$$

then, for equation (10) to hold, it must also be true that the number of illiterate children is lower in time *t+1* (after adjusting for population growth through multiplying by τ) and hence that the proportion of the age-specific population that is functionally literate has increased. Dividing both sides of equation (11) by $LIT_{i,t}$, this condition can also be expressed as follows:

$$\frac{\tau.LIT_{i,t+1}}{LIT_{i,t}} > 1 \tag{12}$$

We call the left-hand side of equation (12) the basic human capital production ratio, which if greater than one indicates that a country has improved the production of basic literacy (or numeracy) between time *t* and *t+1*, and if less than one indicates that a country's production of basic literacy (or numeracy) has deteriorated.

In order to calculate these basic human capital production ratios we use the raising factor variable provided in the SACMEQ datasets. 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 obtained this raising factor through first adjusting official school census data estimates of grade 6 enrolments in response to actual enrolments as observed in schools during the SACMEQ fieldwork. This adjusted sampling frame was then used to calculate the probability of selection into the sample and hence the raising factor variable. Therefore, these estimates of the total grade 6 population in each country should be more accurate than official administrative data, which are typically used to calculate Gross Enrolment Ratios and the like. It is possible to inflate any subgroup within the SACMEQ sample to the estimated population total of enrolled grade 6 students for that subgroup. For example, one can calculate the estimated total number of functionally literate grade 6 students in each country ($LIT_{i,t}$).

United Nations (2012) medium variant population estimates for 10 - 14 year olds were used to calculate an appropriate population growth deflator (τ) so as to make the total number of grade 6 students in 2007 comparable with that in 2000. 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 B. Under the assumption that population growth between 2000 and 2007 amongst different population subgroups was not significantly correlated with the likelihood of being enrolled, the population growth deflator (τ) is multiplied by the total number of functionally literate (numerate) children in 2007 to obtain ($\tau . LIT_{i,t+1}$).

The disadvantage of this method is that country-specific school census data may not have been consistently measured in 2000 and 2007, and when combined with population growth adjustments could lead to anomalistic changes in enrolments. For example, the raising factor variable for Mauritius and Seychelles (two countries not central to this analysis due to their advanced stage of development) indicates lower absolute grade 6 enrolments in 2007 than in 2000. However, these two countries are known to have stabilised at near universal enrolment amongst primary school aged children. SACMEQ officials also warned us that some loss of data in the cases of Malawi and Zambia detract somewhat from the reliability of the raising factor variable in these countries. Sensitivity to measurement error therefore means that small changes are not strongly interpreted in this paper. Rather, conclusions are based on the overall picture emerging from clearly substantial changes in the majority of countries.

c) Estimation Method 2

In order to gauge the sensitivity of our findings we also employ a second more straightforward method of estimating the change in the production of human capital between 2000 and 2007 using household survey data for enrolment rates. In another paper (Spaull and Taylor, 2012) we propose a single composite measure of school system performance that combines access to schooling with the quality of schooling called “effective enrolment”. The effective enrolment rate is defined as the proportion of the total age-appropriate population (enrolled and not enrolled) that has reached a basic minimum level of literacy or numeracy. The effective enrolment rate in country *i* at time *t*

($EE_{i,t}$) is therefore the product of the age-specific enrolment rate ($ENR_{i,t}$) and the proportion of students that have achieved functional literacy or numeracy ($Q_{i,t}$):

$$EE_{i,t} = ENR_{i,t}Q_{i,t} \tag{13}$$

The disadvantage of this second method, however, is that comparable household data are not available for the exact years of 2000 and 2007 for all the countries of interest. Nevertheless, "effective enrolment" rates for a selection of countries in 2000 and 2007 are calculated using SACMEQ data in those years and DHS (or strictly comparable household survey data) in the nearest possible years.

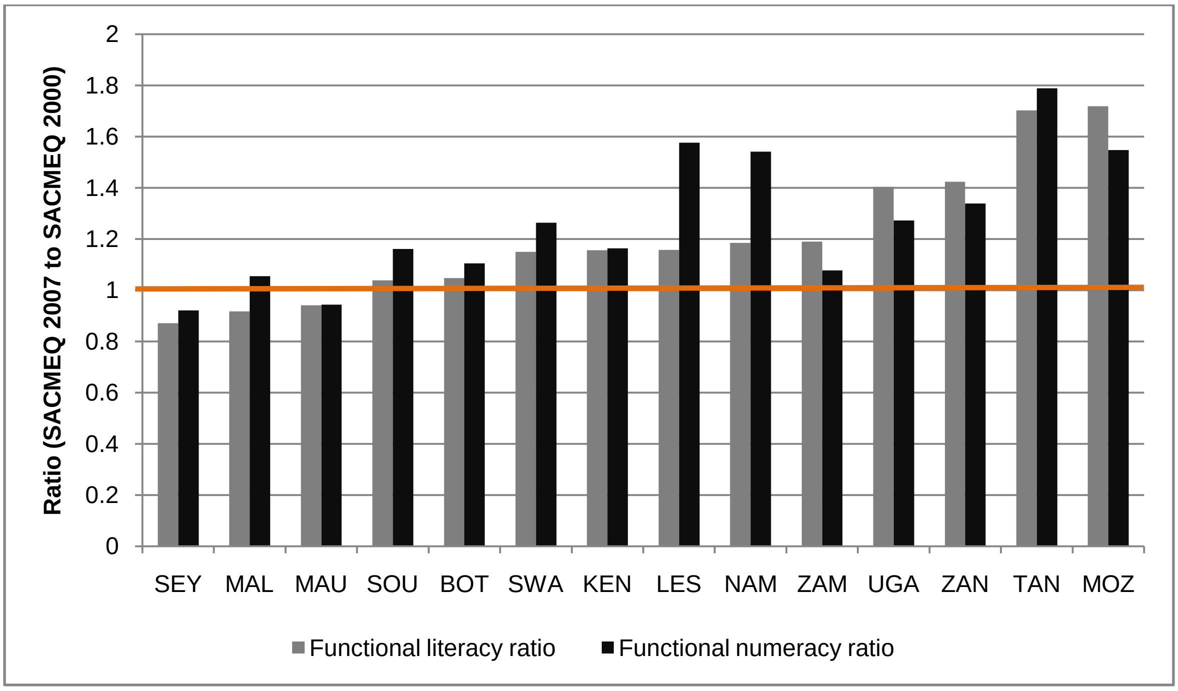
4. EMPIRICAL FINDINGS

a) Estimation Method 1

Figure 3 shows the basic human capital production ratios as defined in equation (12). For all 14 education systems the ratios for literacy and numeracy are reported. As demonstrated in the previous section, a ratio that is greater than one means that an education system produced more functionally literate (numerate) children in 2007 than in 2000. Given the adjustment for population growth and the assumption that grade 6-aged children not enrolled in school are functionally illiterate (and innumerate), a ratio that is greater than one also means that the proportion of grade 6-aged children in the population that is functionally literate (or numerate) increased between 2000 and 2007.

Figure 3 indicates that in all countries where grade 6 enrolments expanded, basic human capital production ratios were greater than one. Only Seychelles, Mauritius and Malawi (in the case of literacy) had ratios of less than one. Seychelles and Mauritius are two of the best-performing education systems in SACMEQ and have had near universal enrolment for some time. Average SACMEQ scores remained stable in the Seychelles and actually improved in Mauritius. Therefore, the apparent slight decline in the production of basic literacy and numeracy in these two countries is probably a reflection of the lower absolute grade 6 enrolments recorded in SACMEQ 2007, fluctuations unlikely to be representative of an underlying reality or trend.

Figure 3: *"Basic human capital production ratios" by country for literacy and numeracy*

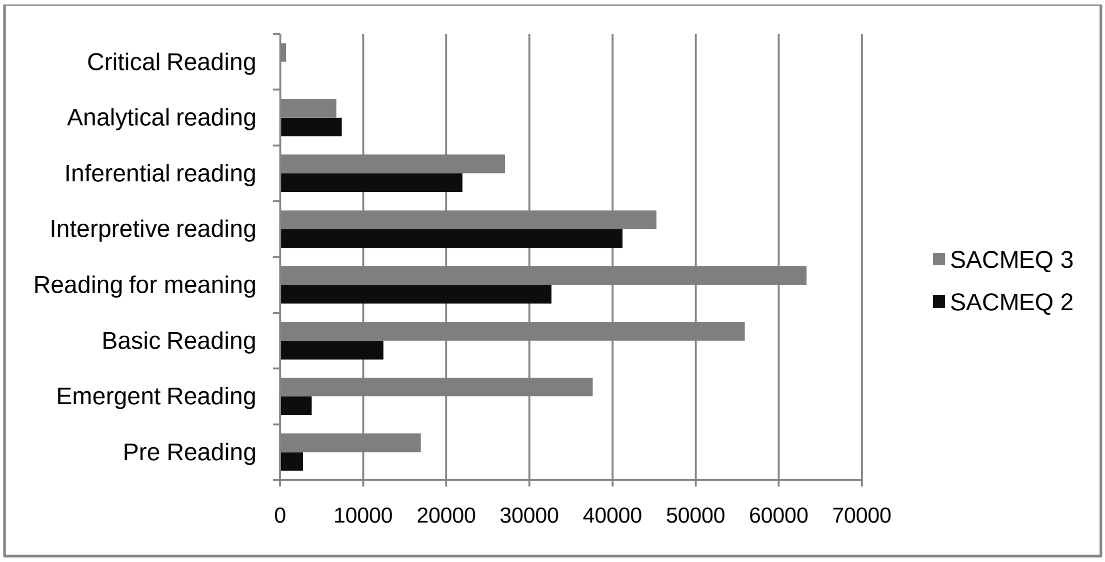


In the case of Malawi, there are two considerations to keep in mind when interpreting the apparent slight decline in functional literacy. Firstly, according to the UN medium variant population estimates, the growth in the population of 10-14 year olds in Malawi was the highest of all the SACMEQ countries during the period of 2000 to 2007. Thus, although more children were enrolled in grade 6 in 2007 than in 2000,it would seem that this increase in enrolments could not keep pace with the rapid growth of the population. Secondly, SACMEQ officials cautioned us that there was some doubt about the estimated grade 6 population size in Malawi (along with Zambia) due to data loss. In the case of Zambia the estimated change in grade 6 enrolments obtained from SACMEQ data is roughly similar in direction and magnitude to the change in enrolment rates observed in the Filmer (2010) household survey data (Table 1). However, in the case of Malawi, the household survey data indicate that the enrolment rate amongst 14 year-olds actually increased from 79% in 2000 to 86% in 2005 and 88% in 2010 (Filmer, 2010). Therefore, the decline in basic human capital production in Malawi according to this measure should be interpreted cautiously.

Overall, these basic human capital production ratios provide strong evidence that expanding access in Southern and Eastern Africa since 2000 was not accompanied by a decline in the attainment of basic literacy and numeracy. In fact, increased access was accompanied by improvements in basic human capital production. Moreover, the ratios calculated here can be regarded as conservatively low for two reasons. Firstly, declining levels of grade repetition (which the SACMEQ data indicate was true for most of these countries between 2000 and 2007) may mean that grade 6 cohorts become slightly smaller, holding population growth and enrolment rates constant. Secondly, one might argue that adjusting for population growth is a somewhat strict imposition. For example, if a country manages to keep the same *proportion* of children enrolled and achieving at the same average level despite a rapid increase in the *numbers* enrolled due to population growth, this will produce a "basic human capital production ratio" of one (i.e. no improvement). Yet even this might be considered a fair achievement. Nevertheless, we impose the population growth adjustment to ensure that the arguments set forth in this paper are based on conservative assumptions.

It is possible not only to show the population adjusted numbers of children reaching functional literacy (or numeracy) but also to show the numbers achieving at all eight competency levels. Figure 4 shows the numbers of children in Mozambique that achieved at all eight levels of reading performance in 2000 and in 2007. These numbers are again inflated to represent the numbers in the grade 6 student population that achieved at each competency level, and adjusted for population growth. The large increases in the numbers of children achieving at low competency levels explain why the Mozambique average score declined. However, the majority of those children bringing the average down in 2007 would not have been in school had the enrolment rate of 2000 still prevailed. The important thing is that, except perhaps for the category of "analytical reading" where the numbers remained much the same, more children reached each competency level in 2007 than in 2000, even after adjusting for population growth. When one looks at the case of Mozambique in this way it seems that the expanded access to primary schooling was an unambiguously positive development.

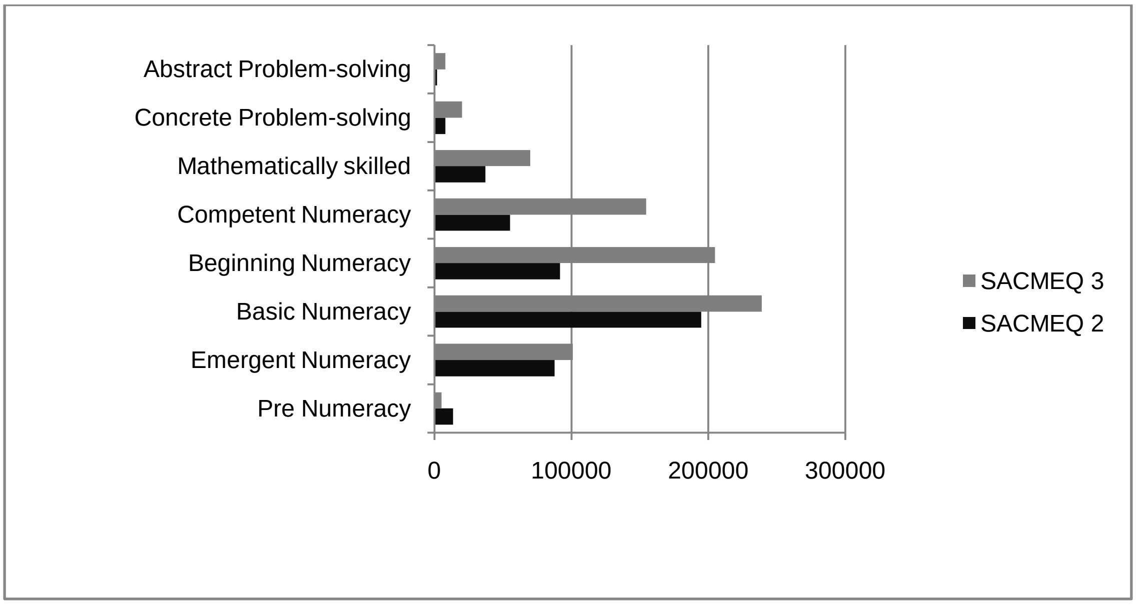
Figure 4: *Numbers of children achieving at various levels of reading performance in Mozambique*



Note: Numbers adjusted for population growth

Figure 5 shows the numbers of children in Tanzania that achieved at each of the mathematics competency levels in 2000 and in 2007. Again it is clear that more children in the population reached every competency level in 2007. Similar graphs for all 14 education systems for both literacy and numeracy are provided in Appendix B.

Figure 5: *Numbers of children achieving at various levels of mathematics performance in Tanzania*



Note: Numbers adjusted for population growth

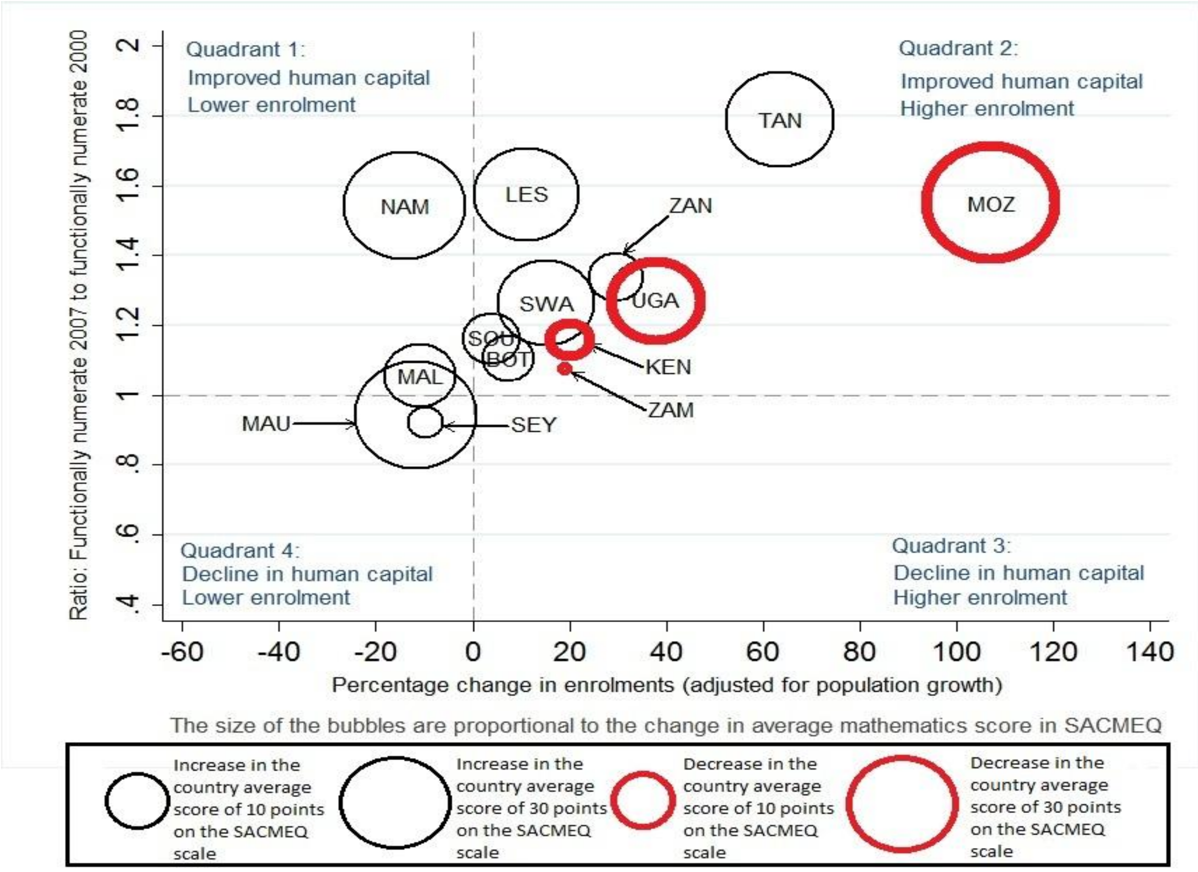
Figure 6 consolidates all the information about changes in access, changes in the SACMEQ average score and changes in human capital production into a single graph. The horizontal axis shows the percentage change in grade 6 enrolments (after adjusting for population growth) for each country. The vertical axis shows the "basic human capital production ratio" for numeracy in each country. The size of the bubbles indicates the magnitude of the change in the average mathematics 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 graph shows four quadrants corresponding to the four combinations of increases or decreases in access and increases or decreases in human capital production. Some countries appear to have improved human capital production while holding enrolments fairly constant. Namibia is the main example of this, although Mauritius also seems to have improved from a base of high enrolment and fairly high average achievement in 2000.[10]

Most importantly, all of the countries that expanded access between 2000 and 2007 are located in the top right quadrant of improved basic human capital. This includes countries in which average test scores improved, such as Tanzania, and countries in which average test scores decreased, such as Mozambique and Uganda.

[10] As discussed earlier, the fact that Mauritius falls into the bottom left quadrant is probably due to a combination of measurement error in the grade 6 enrolments data of 2000 and/or 2007 and in the UN population estimates between 2000 and 2007.

Figure 6: *The production of basic human capital and access to school between 2000 and 2007*



It is also interesting that the size of the thick red bubbles (for countries with lower average achievement) increases along the x-axis but so do human capital ratios. This demonstrates how if one's measure of quality is the SACMEQ average score one might conclude that larger expansions were associated with larger trade-offs with quality. However, if one's measure of the success of an education system is the achievement of basic skills for the entire student-aged population (enrolled and not enrolled), larger expansions were associated with larger improvements in skills production, in other words larger movements along the y axis.

The fact that there are no countries located in the bottom right quadrant of Figure 6indicates that in no countries that expanded access between 2000 and 2007 did the primary school system produce less basic literacy and numeracy.

b) Estimation Method 2

Due to our preference for household survey data as a source of enrolment information compared with administrative data, we also calculate "effective enrolment" rates as defined in equation (13) above. The effective enrolment rate in country *i* in time *t* is simply the product of the age-specific enrolment rate corresponding to the median age of the grade 6 student sample in SACMEQ ($ENR_{i,t}$) and the proportion of students in the SACMEQ sample that have achieved functional literacy or numeracy ($Q_{i,t}$). In other words this is simply the product of the numbers reported in Tables 1 and 2, i.e. only that proportion of enrolment that produces learning. There are ten countries for which DHS or strictly comparable household survey data exist for both 2000 and 2007 (or near enough years). The effective enrolment rates for these countries in 2000 and in 2007 are shown in Figures 7 (for literacy) and 8 (for numeracy). In another paper (Spaull and Taylor, 2012) we also present the effective enrolment rates by gender, geographical location and wealth quintiles for ten of the 14 countries.

Figure 7: *Proportion of grade 6-aged children functionally literate in 2000 and 2007*

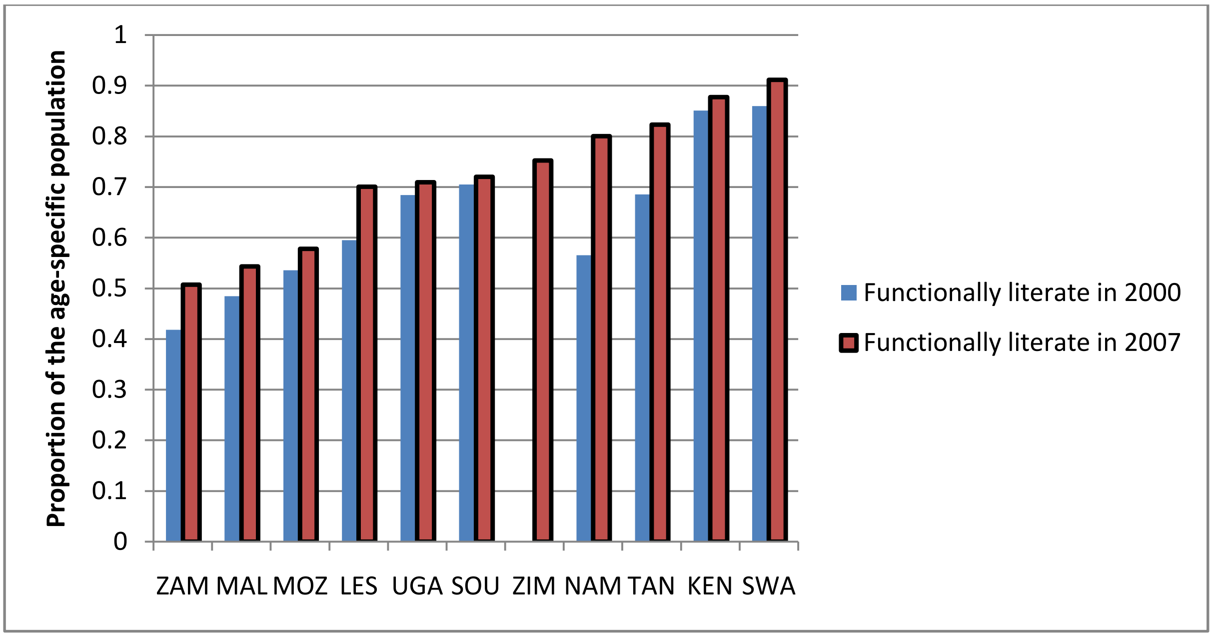


Figure 8: *Proportion of grade 6-aged children functionally numerate in 2000 and 2007*

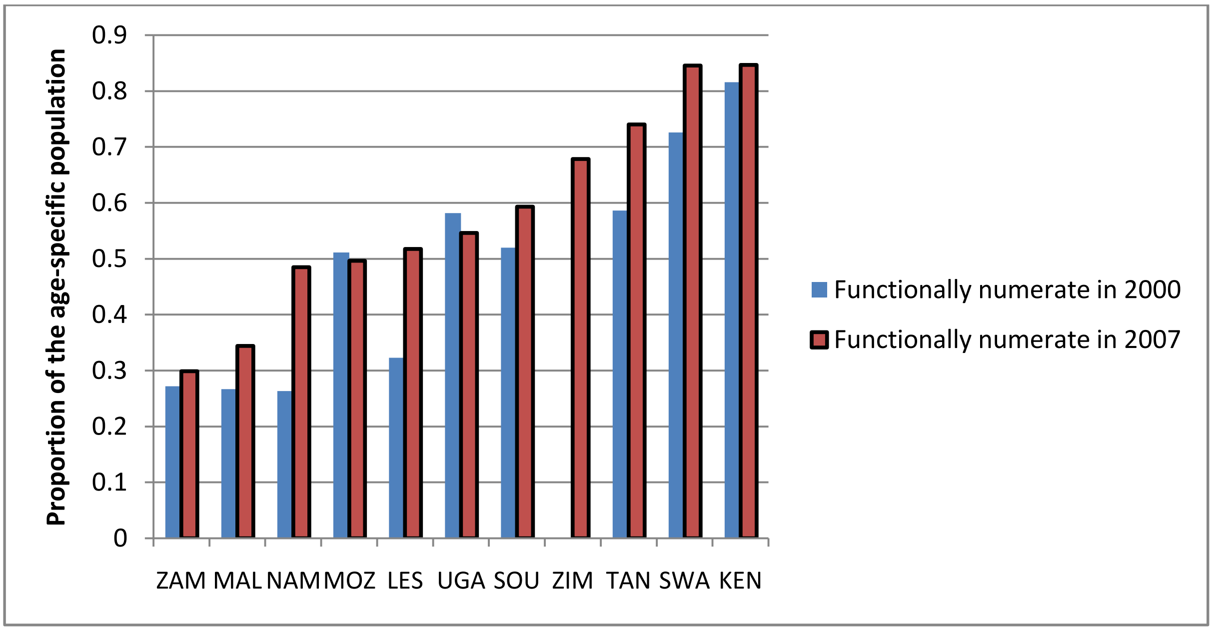


Figure 7 shows that in all ten countries the proportion of grade 6-aged children that was functionally literate was higher in 2007 than in 2000. In the case of numeracy (Figure 8), only Mozambique and Uganda appear to have experienced a slight decline in the proportion of children that were functionally numerate. In the case of Mozambique, it is unfortunate that household data were only available in 1997 and 2003, thus providing a weak match to the years with achievement data. Other sources (the SACMEQ raising factor variable and the Ministério da Educação e Cultura, 2012) indicate that the expansion in Mozambique up until 2007 was even more dramatic than the DHS data would suggest. Similarly, the DHS data for Uganda indicate a marginal expansion from 88% in 2000 to 89% in 2006. Therefore, the slight decline in the proportion of children reaching functional numeracy in Uganda cannot be attributed to an expansion. Instead, the overwhelming pattern that is evident in all these results is that large expansions were associated with substantial improvements in the proportion of children in the overall population acquiring literacy and numeracy skills.

5. DISCUSSION

a) Does economic growth explain both increased access and improved skills?

Although this paper primarily aims to clarify what happened to education system performance in countries that expanded access to schooling rather than to neatly identify the causal impact of access on skills production, it is of course true that the actual effects of increasing access are of great significance both to future policy and to development theory. Therefore, a sceptic could mount the following endogeneity challenge to our findings: both increased access and increased production of basic skills may have been driven by (and are thus conditional on) another factor such as economic growth. After all, the period from 2000 to 2007 was one of strong economic growth, even *per capita* growth, throughout the region.

Several points can be made in response to such a concern. Firstly, we would concede that economic growth should be expected to positively contribute to education quality, as demonstrated earlier in equations (4), (5) and (6). Therefore, we would caution that in a decade of low economic growth a policy-led expansion (for example in compliance to international expectations) might not lead to equally impressive improvements in skills due to tighter resource constraints and weaker home support. However, the conceptual model introduced in Section 3 shows that even in a context of zero or negative growth, increasing the opportunity to learn through access could more than offset any negative effects on achieved learning caused by social composition or resource effects.

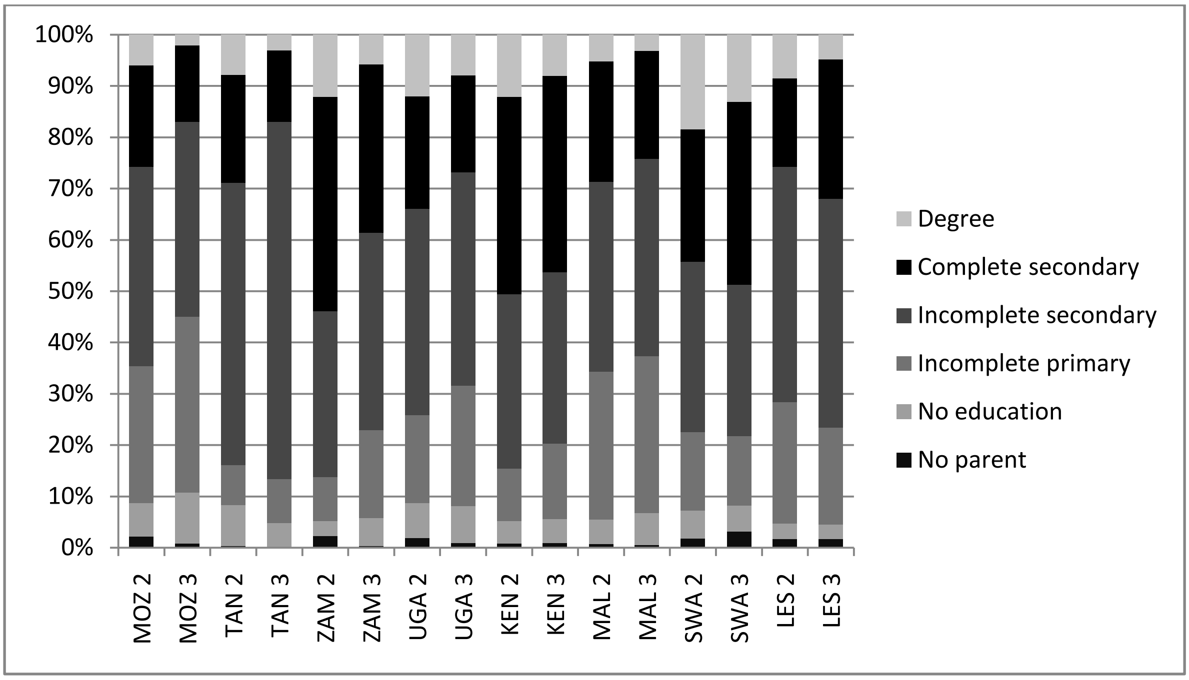
Secondly, we would submit that the increase in access since 2000 in Southern and Eastern Africa was influenced by deliberate national policies such as abolishing school fees and global initiatives such as the EFA drive. The increases in access and skills were not merely inexorable consequences of economic growth.

Thirdly, the sheer magnitude of the changes in access and skills production makes it both improbable that economic growth without policies of expansion would have produced the same improvement in skills and likely that these policies of expansion would at least have produced some improvement in the production of basic skills in the absence of economic growth. Therefore, even if economic growth contributed to the success story outlined in this paper, the role of policies expanding access to schooling was also important.

b) The effects of expanded access on social composition and resources per student

The household data provided by Filmer (2010) confirm that children from lower wealth quintiles are more likely to be excluded from school access 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. Figure 9 demonstrates that in most countries that expanded grade 6 enrolments between 2000 and 2007 there were lower proportions of parents with higher levels of education. In contrast, the profile of parent education in countries where access was already high in 2000 remained constant or improved somewhat (e.g. South Africa, Mauritius, Botswana and Namibia – figures not reported here).

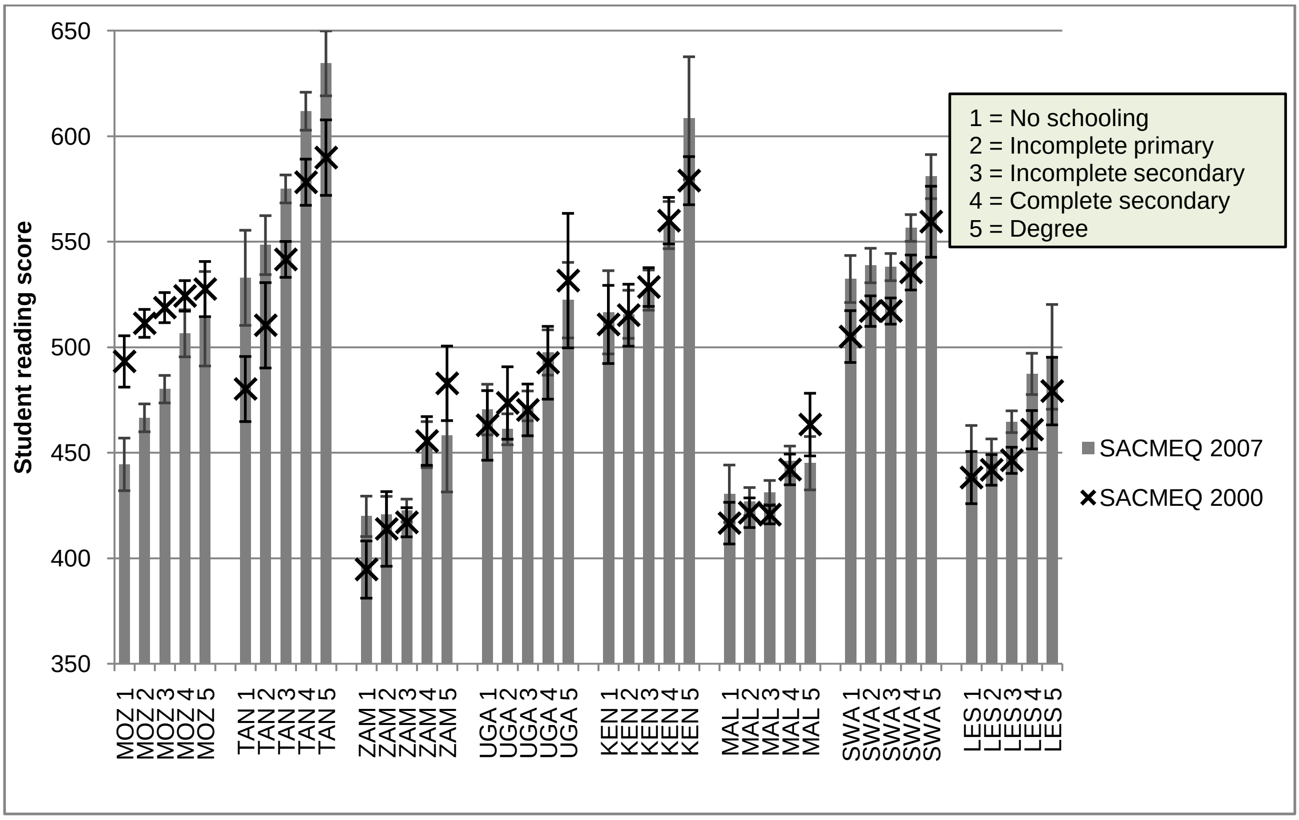
Figure 9: *Levels of parent education in SACMEQ 2 and 3 in countries that expanded access*



Note: The picture for Zanzibar is similar to that for Tanzania

Given the strong relationship between socio-economic status and educational outcomes (Filmer and Pritchett, 1999; Lee *et al.*, 2005), one would expect the changing social composition of those attending school to adversely affect average scores in SACMEQ. Figure 10 shows reading achievement for countries that expanded enrolments by level of parental education, in 2000 and 2007. In most countries, the average achievement for given levels of parental education remained fairly stable between 2000 and 2007. In Tanzania and Swaziland reading achievement even improved at given levels of parental education. Only in Mozambique did grade 6 students in 2007 perform worse than grade 6 students with equally educated parents in 2000. This confirms Crouch's (2011) argument that social composition does not completely explain Mozambique's decline in average achievement.

Figure 10: *Mean reading achievement by parent education in SACMEQ 2 and 3 in countries that expanded access*



Notes: 95% Confidence Intervals are indicated. The small category of "No parent" is not depicted. The picture for Zanzibar is similar to that for Tanzania.

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 3 describes the state of selected resources in 2007 and the change in those resources between 2000 and 2007 in the countries that expanded enrolments. Most countries did experience worsening pupil-teacher ratios and ratios of permanent classrooms to students over the period. However, access to these resources either improved or remained fairly stable in Swaziland, Lesotho and Uganda despite expanding enrolments. In Uganda, despite this slight improvement in resourcing, the average SACMEQ score declined slightly (in numeracy). In contrast, resources in Kenya, Zanzibar and Tanzania were significantly stretched but this did not stop the average SACMEQ scores from remaining stable or improving. One noteworthy feature of Kenya and Tanzania is that pupil-teacher ratios increased considerably but the quality of those 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. Michaelowa (2001) conducted an education production function analysis for five Francophone African countries and concluded that the negative effects of large classes can be more than offset by a better mix of inputs. In particular, access to textbooks was found to have large effects relative to class size and is far less costly. In this way, Michaelowa argues, the expansion of enrolments can be efficiently negotiated.

Table 3: *Selected school resources in countries that expanded enrolments between 2000 and 2007*

	Average maths teacher score		**Proportion of pupils with access to reading textbooks**		**Pupils per permanent classroom**		**Pupil-teacher ratio**	
	2007	Change from 2000	2007	Change from 2000	2007	Change from 2000	2007	Change from 2000
Kenya	906.1	-6.1%	39%	-21.9%	63.5	33.9%	42.9	27.0%
Mozambique	745.6	-4.8%	67%	-8.8%	190	20.2%	58	13.0%
Tanzania	825.8	4.0%	13%	-17.0%	100.2	4.0%	62.9	33.6%
Uganda	833.3	1.3%	32%	20.2%	114.1	-14.0%	55.7	-4.0%
Malawi	762.4	-1.8%	37%	-48.9%	160.3	9.1%	88.0	25.7%
Swaziland	811.1	0.4%	99%	10.3%	41.8	2.2%	34.2	-2.5%
Lesotho	738.8	-0.1%	75%	5.3%	60.2	-28.4%	41.8	-22.4%
Zambia	740.4	-2.5%	43%	4.0%	97.9	20.8%	74.5	38.7%
Zanzibar	683.9	-0.8%	65%	396.7%	94.6	-16.4%	29.4	-15.8%

Although Table 3 does not indicate any strong pattern about what resources are important to protect when expanding enrolments, these observations are at least consistent with one of the findings of the education production function literature, 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 (Hanushek, 2002; Van der Berg, 2008).

Figure 10 and Table 3 indicate that most countries were able to maintain student achievement at given levels of parental education despite tighter resource constraints. Even in Mozambique, where resources were clearly stretched and where the SACMEQ average score declined, an improved production of basic literacy and numeracy in the overall population of grade 6-aged children was achieved through providing greater access to schools.

c) Further benefits to the expansion of access to primary schooling

As demonstrated, expanded access to primary schooling in Southern and Eastern African countries between 2000 and 2007 was almost unanimously accompanied by increases in the proportion of the age-specific population that successfully acquired basic literacy and numeracy skills. A further positive aspect of this development is that girls benefited especially. Elsewhere (Taylor and Spaull, forthcoming) we compare the “effective enrolment” rates for boys and girls between 2000 and 2007. Several points are worth highlighting here.

In Southern African countries girls tend to enjoy better access to school and perform better when in school whereas in Eastern African countries the pattern is one where girls are typically at a disadvantage. Gender gaps are typically greater when one considers effective enrolment rates than when one looks at either enrolment or test scores in isolation. Out of the six countries where girls were at a disadvantage in 2000, those gaps diminished substantially in four countries, remained constant in Zambia and worsened somewhat in Malawi. In Mozambique the decline in the disadvantage facing girls was considerable: the gap in the proportion of the population reaching functional literacy between girls and boys decreased from about 20 percentage points in 2000 to about nine percentage points in 2007.

Another beneficial corollary of expanding access through reducing financial constraints to school attendance is that late entry amongst poor children may decline. Grogan (2009), for example, found that the introduction of free primary education in Uganda led to a reduction in late entry to school. The SACMEQ data show that for children of parents with less than complete education in the countries that expanded enrolments between 2000 and 2007, the proportion of children that had entered school late declined from 29.5% in 2000 to 25.1% in 2007.[11] This is an important trend given that late entry is typically associated with drop-out.

Some have raised the concern that increased access to primary school may have limited benefits if this does not also lead to increased throughput to higher levels of education. This concern is particularly applicable when the marginal returns to education in the labour market are larger for secondary and tertiary education than for primary education. Resource constraints such as physical infrastructure or the supply of teachers can create bottlenecks at higher levels of education. As Lewin (2007) observes, this is prone to occur when aid programmes are earmarked for primary schooling only and are limited for a specific time period. If this is the case then there may be over-investment in primary school relative to secondary school. Such bottlenecks mean that expanded access can have perverse impacts, including high drop-out in secondary school and of socio-economic status becoming an even stronger determinant of access to higher levels of education (Lewin, 2007: 2). For example, a paper on enrolments in Kenya (Somerset, 2007) shows how the abolition of school fees in 1974 led to a massive increase in grade 1 enrolments with a huge increase in drop-out thereafter. Interestingly, despite Somerset's argument, the data presented in his paper indicate that the numbers reaching grade 7 were still considerably higher due to the increased access.

Tables 4 and 5 use information from DHS surveys in countries where such data were available in a year near or shortly after 2000 and a year near or shortly after 2007, to provide an indication of secondary school participation trends over this somewhat lagged period relative to when the SACMEQ surveys of grade 6 achievement were carried out. Amongst those SACMEQ countries that expanded primary enrolments only Kenya, Lesotho, Tanzania and Zambia had DHS data for suitable years. Table 4 shows that the grade 9 survival rate increased considerably over the relevant period in all four countries. Table 5 shows that the proportion of 16 year-olds that were enrolled in school also increased substantially over the relevant period in all four countries, especially the proportion enrolled in secondary school.

[11] For the purpose of this calculation, access-expanding countries were defined as those which recorded an increase in the age-specific enrolment rate of more than five percentage points according to Table 1 – Kenya, Lesotho, Malawi, Mozambique, Swaziland, Tanzania (including Zanzibar) and Zambia. Late entry is defined here as having already turned eight at the time of first entering primary school.

Table 4: *Grade 9 survival rate amongst 10 -19 year olds*

	Baseline (2003/4)	Recent (2007/8/9/10)
Kenya	0.54	0.76
Lesotho	0.56	0.66
Tanzania	0.21	0.43
Zambia	0.64	0.71

Source: World Bank (2012) using the 2003 and 2008/9 DHS surveys for Kenya, the 2004 and 2009 DHS surveys for Lesotho, the 2004 and 2010 DHS surveys for Tanzania, the 2003 LCMS survey for Zambia and the 2007 DHS survey for Zambia.

Note: These rates have been adjusted by the World Bank for right-censoring – the fact that some 10 -19 year olds have not yet reached grade 9.

Table 5: *The proportion of 16 year-olds enrolled in either primary or secondary school*

	Baseline (2003/4)			Recent (2007/8/9/10)		
	% primary	% secondary	% Total	% primary	% secondary	% Total
Kenya	0.60	0.15	0.75	0.65	0.24	0.89
Lesotho	0.46	0.21	0.68	0.28	0.46	0.74
Tanzania	0.38	0.07	0.46	0.22	0.29	0.50
Zambia	0.33	0.32	0.65	0.31	0.48	0.78

Source: Data provided by Filmer (2010) from the 2003 and 2008/9 DHS surveys for Kenya, the 2004 and 2009 DHS surveys for Lesotho, the 2004 and 2010 DHS surveys for Tanzania, the 2003 LCMS survey for Zambia and the 2007 DHS survey for Zambia.

DHS data for Mozambique are not available for the years needed for the comparison, but information obtained from the Ministry of Education provides an indication of progression to higher levels of education. The gross completion rate for level 1 of secondary school went from 2.5% in 2000 to 5.2% in 2004 to 18.0% in 2008 while the gross completion rate for level 2 of secondary school went from 0.6% in 2000 to 1.3% in 2004 to 7.5% in 2008 (Ministério da Educação e Cultura, 2012).[12] Although these are very low completion rates by international standards the improvement over the period has been substantial. Therefore, the evidence from Mozambique and the four countries in Tables 4 and 5 would suggest that the increased primary school access has not been associated with stagnation in secondary school attainment and if anything has contributed to a greater proportion of children completing higher levels of education.

Finally, there may also be intergenerational benefits to increasing access to primary education through producing more educated parents for the next generation of children. With this in mind, Crouch and Fasih (2004) examine the relationship between learner performance in the 1990s and a lagged measure of access (from the 1970s). Using a selection of about 50 countries, Crouch and Fasih found a positive correlation between learning in the 1990s and the residuals of a regression

[12] The gross completion rate is defined as the number completing that phase as a percentage of the population of the corresponding ages.

predicting access in the 1970s, controlling for GDP per capita. Therefore, countries that expanded access in the 1970s to a level beyond the norm for their economic development experienced better school performance in the 1990s. Similarly, Mingat (1998) finds a positive relationship between policies of expanding access to primary education in Asian countries in the 1950s and economic growth in the period 1960-1992. Mingat argues that a strong initial focus on primary education was a key factor in the success of high-performing Asian economies and education systems.

6. CONCLUSION

Viewing country average test scores or enrolment rates in isolation is misleading, particularly when evaluating trends over time. A decline in a country average score does not necessarily reflect deterioration in the education system. In order to meaningfully assess education system performance in countries with incomplete access to education it is necessary to use a combined measure of access and quality. Using the notion of "effective enrolment" – the proportion of an age-specific population achieving particular skills levels – this paper has shown that the expansion of access to primary schooling in Southern and Eastern Africa since 2000 contributed to a superior production of literacy and numeracy in these countries. Girls, in particular, benefited from this improvement in the production of literacy and numeracy.

As countries approach universal primary education a similar challenge will emerge around the expansion of access to secondary education. Policy-makers should not shrink back from this objective in fear that the quality of secondary education may suffer. This paper has made the point that simply increasing the opportunity to learn through school attendance is likely to lead to a superior production of human capital in the overall population.

By describing what actually happened in Southern and Eastern Africa over the 2000-2007 period, this paper has shown that the commonly held perception of an access-quality trade-off in Africa has far less empirical support than was previously believed to be the case. Indeed, we find that the substantial expansions of access to primary education since 2000 did not come at the cost of education system effectiveness, but rather facilitated a far greater number of children acquiring foundational numeracy and literacy skills.

Despite these large gains through expanded access, the key challenge going forward is to improve the quality of schooling in these countries. The participation of some Southern African countries in PIRLS and TIMSS in combination with the SACMEQ assessments has indicated that most countries in the region are performing far below developed country standards. Indeed, improving the quality of primary school education may well be the most important component in improving access to secondary and tertiary education in Southern and Eastern African countries. The social benefits of global drives such as EFA will be limited unless the skills of those emerging from the primary phase are improved.

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APPENDIX A

Table 6: *SACMEQ Reading Competency Levels*

Description of levels	Range on 500 point scale	Skills
Level 1 *Pre-reading*	< 373	Matches words and pictures involving concrete concepts and everyday objects. Follows short simple written instructions.
Level 2 *Emergent reading*	373 → 414	Matches words and pictures involving prepositions and abstract concepts; uses cuing systems (by sounding out, using simple sentence structure, and familiar words) to interpret phrases by reading on.
Level 3 *Basic reading*	414 → 457	Interprets meaning (by matching words and phrases, completing a sentence, or matching adjacent words) in a short and simple text by reading on or reading back.
Level 4 *Reading for meaning*	457 → 509	Reads on or reads back in order to link and interpret information located in various parts of the text.
Level 5 *Interpretive reading*	509 → 563	Reads on and reads back in order to combine and interpret information from various parts of the text in association with external information (based on recalled factual knowledge) that “completes” and contextualizes meaning.
Level 6 *Inferential reading*	563 → 618	Reads on and reads back through longer texts (narrative, document or expository) in order to combine information from various parts of the text so as to infer the writer’s purpose
Level 7 *Analytical reading*	618 → 703	Locates information in longer texts (narrative, document or expository) by reading on and reading back in order to combine information from various parts of the text so as to infer the writer’s personal beliefs (value systems, prejudices, and/or biases).
Level 8 *Critical reading*	703+	Locates information in a longer texts (narrative, document or expository) by reading on and reading back in order to combine information from various parts of the text so as to infer and evaluate what the writer has assumed about both the topic and the characteristics of the reader – such as age, knowledge, and personal beliefs (value systems, prejudices, and/or biases).

Source: SACMEQ (2010)

Table 7: *SACMEQ Mathematics Competency Levels*

Description of levels	Range on 500 point scale	Skills
Level 1 *Pre-numeracy*	< 364	Applies single step addition or subtraction operations. Recognizes simple shapes. Matches numbers and pictures. Counts in whole numbers.
Level 2 *Emergent numeracy*	364 → 462	Applies a two-step addition or subtraction operation involving carrying, checking (through very basic estimation), or conversion of pictures to numbers. Estimates the length of familiar objects. Recognizes common two-dimensional shapes.
Level 3 *Basic numeracy*	462 → 532	Translates verbal information presented in a sentence, simple graph or table using one arithmetic operation in several repeated steps. Translates graphical information into fractions. Interprets place value of whole numbers up to thousands. Interprets simple common everyday units of measurement.
Level 4 *Beginning numeracy*	532 → 587	Translates verbal or graphic information into simple arithmetic problems. Uses multiple different arithmetic operations (in the correct order) on whole numbers, fractions, and/or decimals.
Level 5 *Competent numeracy*	587 → 644	Translates verbal, graphic, or tabular information into an arithmetic form in order to solve a given problem. Solves multiple-operation problems (using the correct order of arithmetic operations) involving everyday units of measurement and/or whole and mixed numbers. Converts basic measurement units from one level of measurement to another (for example, metres to centimetres).
Level 6 *Mathematically skilled*	644 → 720	Solves multiple-operation problems (using the correct order of arithmetic operations) involving fractions, ratios, and decimals. Translates verbal and graphic representation information into symbolic, algebraic, and equation form in order to solve a given mathematical problem. Checks and estimates answers using external knowledge (not provided within the problem).
Level 7 *Concrete problem solving*	720 → 806	Extracts and converts (for example, with respect to measurement units) information from tables, charts, visual and symbolic presentations in order to identify, and then solves multi-step problems.
Level 8 *Abstract problem solving*	>806	Identifies the nature of an unstated mathematical problem embedded within verbal or graphic information, and then translate this into symbolic, algebraic, or equation form in order to solve the problem.

Source: SACMEQ, 2010

APPENDIX B

Table 8: *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 -1 4 year-olds in 2000**	**Population of 10 -1 4 year-olds in 2005**	**Population of 10 -1 4 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**
Botswana	36015	37240	222000	221000	216000	-0.0046	218986	-0.014	37746	1.05
Kenya	555585	685722	4283000	4387000	4821000	0.0190	4555703	0.064	642061	1.16
Lesotho	29392	35554	256000	265000	270000	0.0037	266989	0.043	34028	1.16
Malawi	98012	122846	1400000	1688000	1914000	0.0254	1775008	0.268	89940	0.92
Mauritius	22037	21002	106000	111000	102000	-0.0168	107308	0.012	20742	0.94
Mozambique	115788	250581	2218000	2523000	2918000	0.0295	2674142	0.206	199048	1.72
Namibia	30287	41674	230000	258000	268000	0.0076	261954	0.139	35884	1.18
Seychelles	1414	1337	79000	84000	87000	0.0070	85187	0.078	1232	0.87
South Africa	656110	675350	5021000	4979000	4963000	-0.0006	4972594	-0.010	681861	1.04
Swaziland	24775	27639	158000	156000	149000	-0.0091	153161	-0.031	28486	1.15
Tanzania	455161	931624	4345000	4831000	5467000	0.0250	5076003	0.168	774888	1.70
Uganda	258040	487165	3181000	3752000	4392000	0.0320	3995974	0.256	362353	1.40
Zambia	91559	135219	1283000	1436000	1688000	0.0329	1531940	0.194	108982	1.19
Zanzibar	14293	24465						0.168*	20349	1.42
Source	SACMEQ 2	SACMEQ 3	UN	UN	UN	-	-	-	-	-
Formula	-	-	-	-	-	$F_i = \left(\frac{E_i}{D_i}\right)^{0.2} - 1$	$G_i = D_i(1 + F_i)^2$	$H_i = \frac{G_i - C_i}{C_i}$	$I_i = B_i - B_i.H_i$	$J_i = \frac{I_i}{A_i} = \frac{\tau \sum LIT_{i,t+1}}{\sum LIT_{i,t}}$

*Note: The UN population estimates treat Zanzibar and Tanzania as one country, whereas SACMEQ treats them as two education systems. Therefore, the deflator for Tanzania was imputed for Zanzibar on the assumption that population growth was not significantly different between these two areas.
**The letters in the formulas refer to the columns.
***Flit stands for functionally literate.

Table 9: *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 -1 4 year-olds in 2000**	**Population of 10 -1 4 year-olds in 2005**	**Population of 10 -1 4 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**
Botswana	29643	32305	222000	221000	216000	-0.0046	218986	-0.014	32743	1.10
Kenya	532656	662040	4283000	4387000	4821000	0.0190	4555703	0.064	619887	1.16
Lesotho	15950	26259	256000	265000	270000	0.0037	266989	0.043	25131	1.58
Malawi	54021	77816	1400000	1688000	1914000	0.0254	1775008	0.268	56972	1.05
Mauritius	21975	20985	106000	111000	102000	-0.0168	107308	0.012	20726	0.94
Mozambique	110509	215352	2218000	2523000	2918000	0.0295	2674142	0.206	171064	1.55
Namibia	14099	25242	230000	258000	268000	0.0076	261954	0.139	21735	1.54
Seychelles	1247	1245	79000	84000	87000	0.0070	85187	0.078	1148	0.92
South Africa	483519	556346	5021000	4979000	4963000	-0.0006	4972594	-0.010	561710	1.16
Swaziland	20919	25646	158000	156000	149000	-0.0091	153161	-0.031	26431	1.26
Tanzania	389483	837643	4345000	4831000	5467000	0.0250	5076003	0.168	696718	1.79
Uganda	219321	375081	3181000	3752000	4392000	0.0320	3995974	0.256	278985	1.27
Zambia	59584	79704	1283000	1436000	1688000	0.0329	1531940	0.194	64239	1.08
Zanzibar	11139	17936						0.168*	14918	1.34
Source	SACMEQ 2	SACMEQ 3	UN	UN	UN	-	-	-	-	-
Formula	-	-	-	-	-	$F_i = \left(\frac{E_i}{D_i}\right)^{0.2} - 1$	$G_i = D_i(1+F_i)^2$	$H_i = \frac{G_i - C_i}{C_i}$	$I_i = B_i - B_i . H_i$	$J_i = \frac{I_i}{A_i} = \frac{\tau \sum NUM_{i,t+1}}{\sum NUM_{i,t}}$

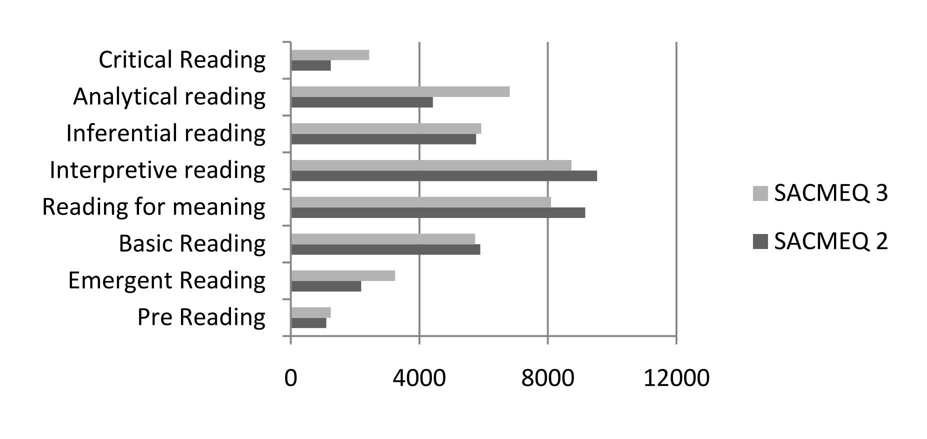
*Note: The UN population estimates treat Zanzibar and Tanzania as one country, whereas SACMEQ treats them as two education systems. Therefore, the deflator for Tanzania was imputed for Zanzibar on the assumption that population growth was not significantly different between these two areas.

**The letters in the formulas refer to the columns.

*** Fnum stands for functionally numerate.

Appendix C

Figure 11: *Numbers of children achieving at various performance levels in literacy and numeracy in Botswana*



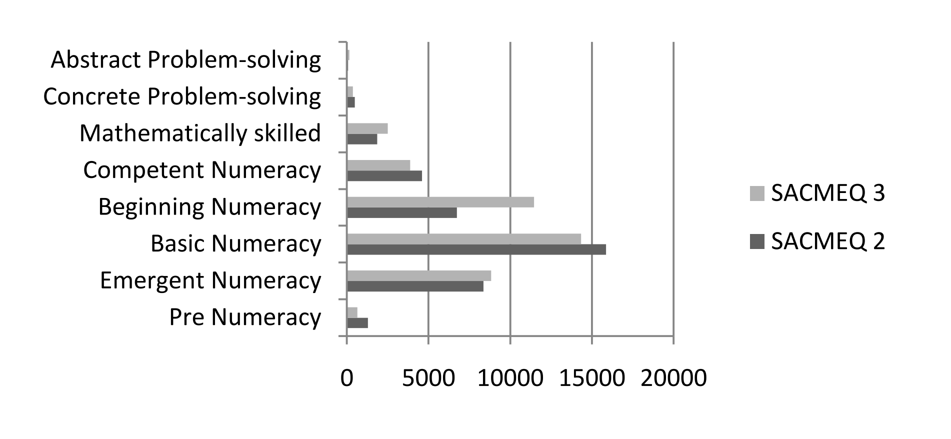
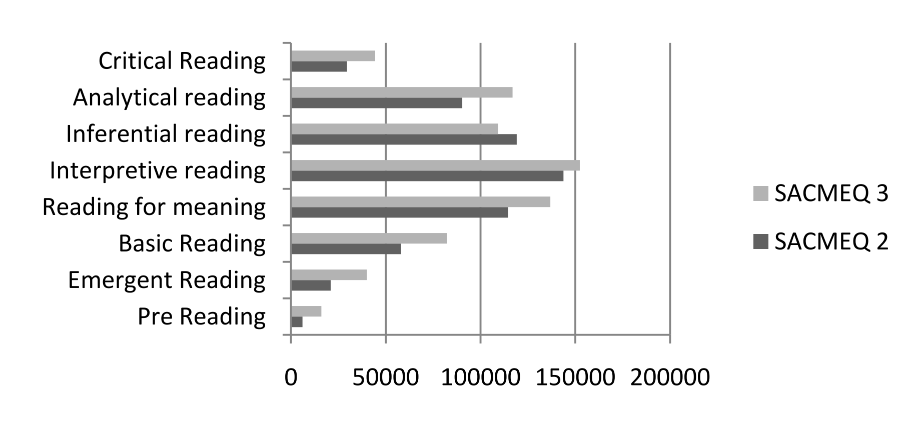


Figure 12: *Numbers of children achieving at various performance levels in literacy and numeracy in Kenya*



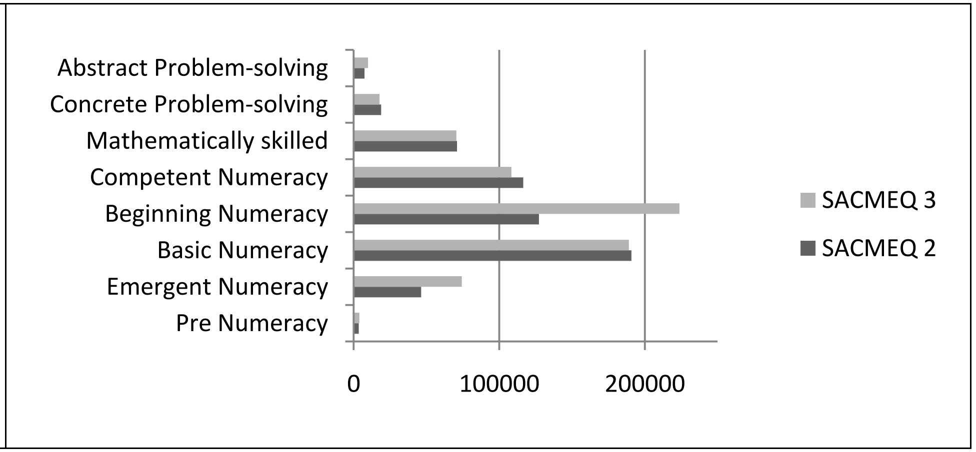
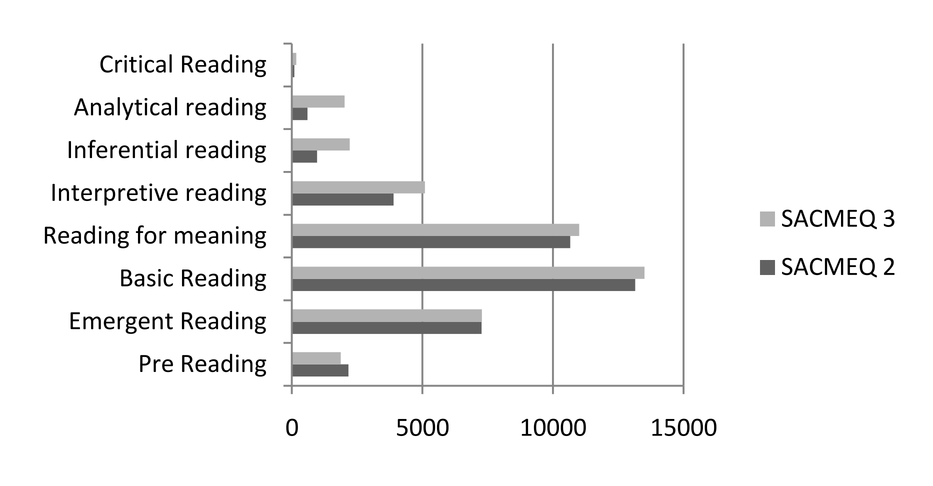


Figure 13: *Numbers of children achieving at various performance levels in literacy and numeracy in Lesotho*



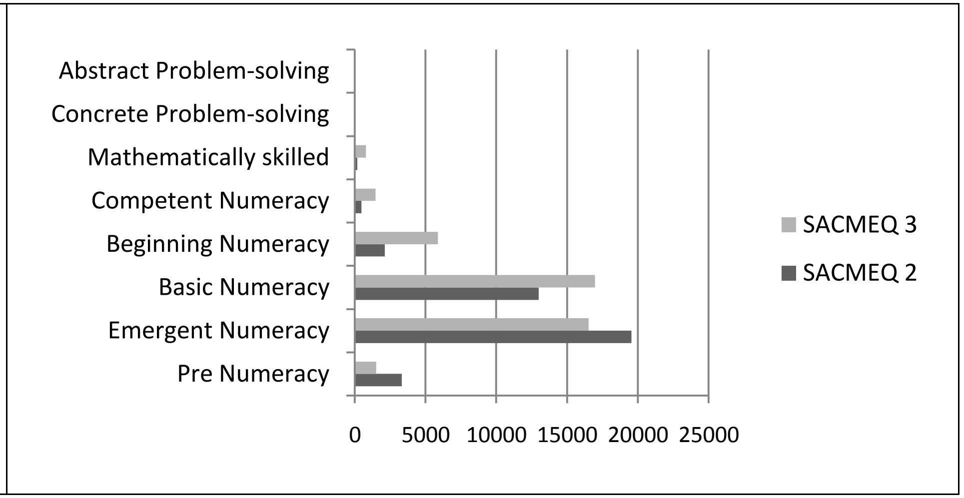
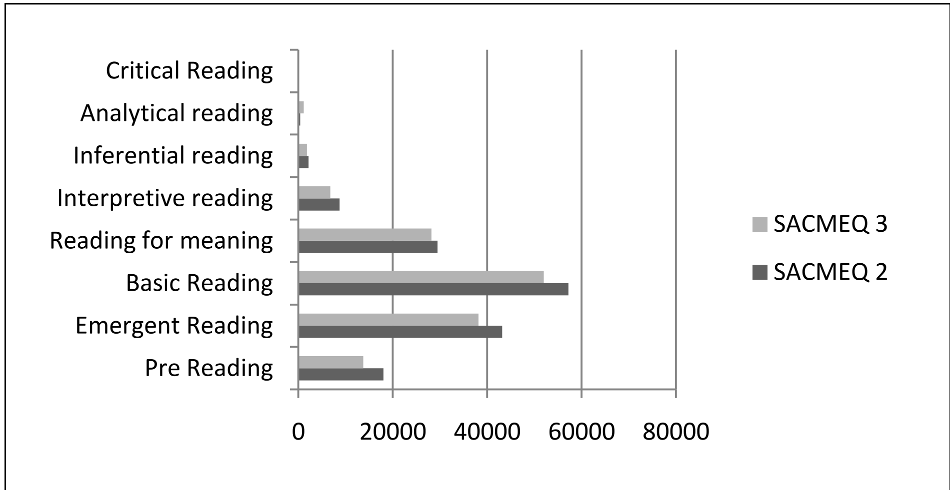


Figure 14: *Numbers of children achieving at various performance levels in literacy and numeracy in Malawi*



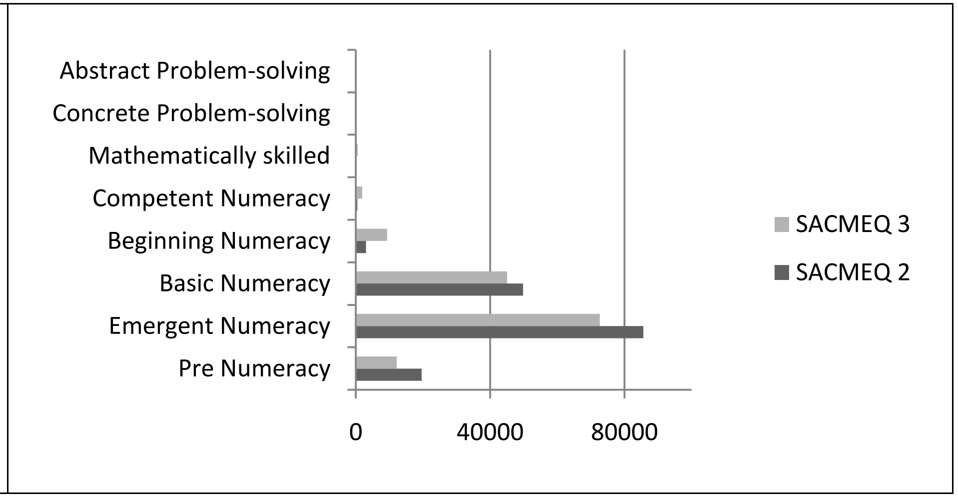


Figure 15: *Numbers of children achieving at various performance levels in literacy and numeracy in Mauritius*

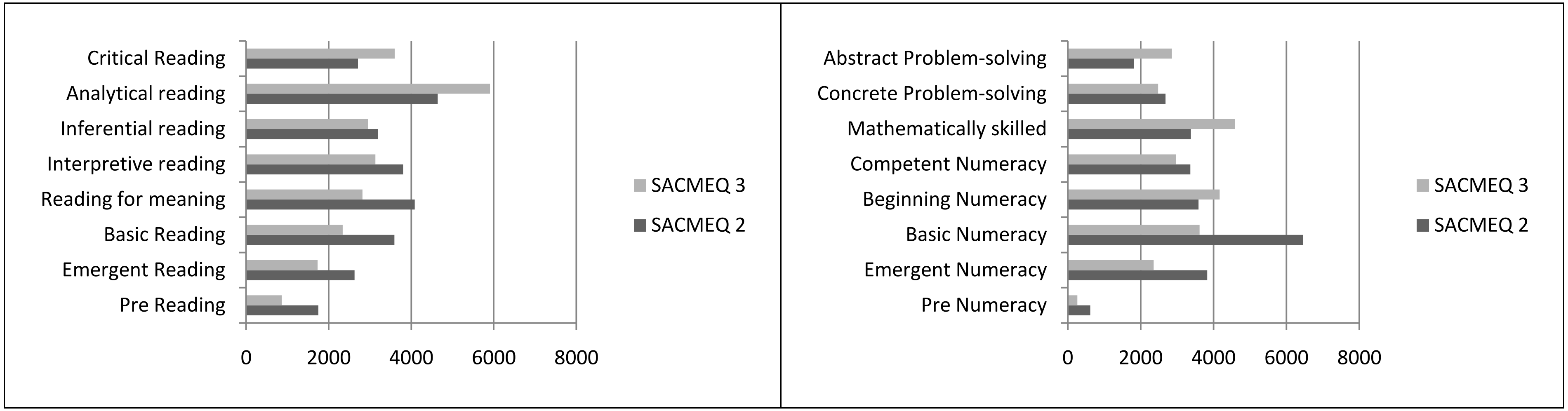


Figure 16: *Numbers of children achieving at various performance levels in literacy and numeracy in Mozambique*

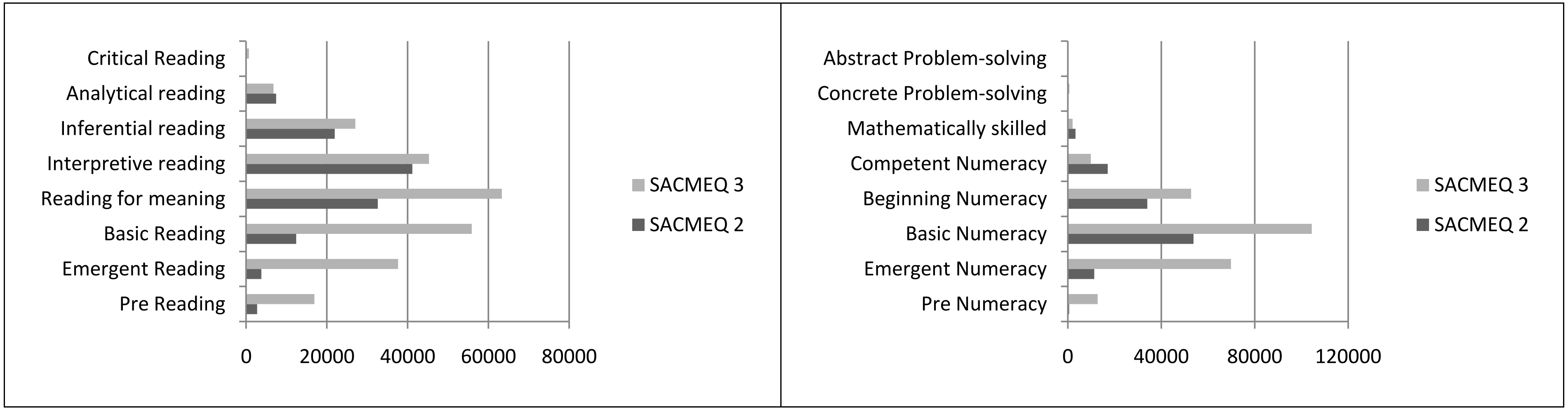


Figure 17: *Numbers of children achieving at various performance levels in literacy and numeracy in Namibia*

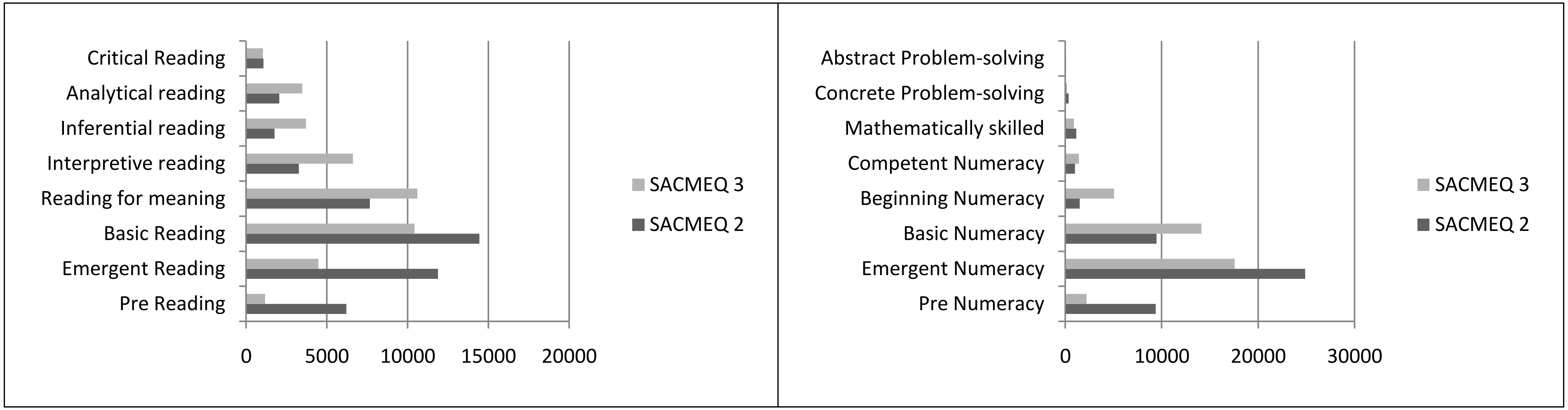


Figure 18: *Numbers of children achieving at various performance levels in literacy and numeracy in Seychelles*

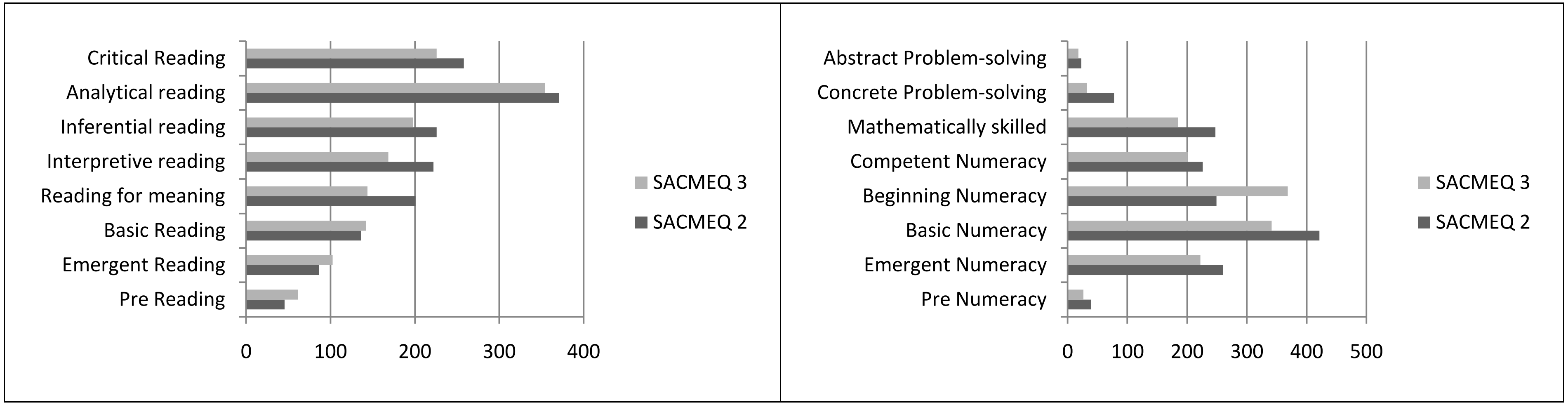


Figure 19: *Numbers of children achieving at various performance levels in literacy and numeracy in South Africa*

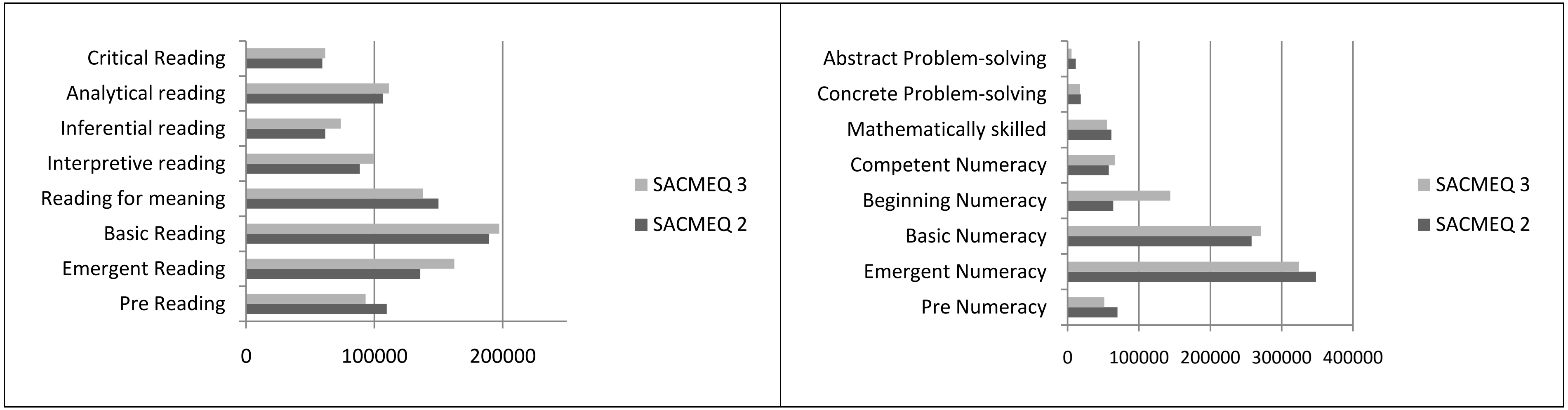


Figure 20: *Numbers of children achieving at various performance levels in literacy and numeracy in Swaziland*

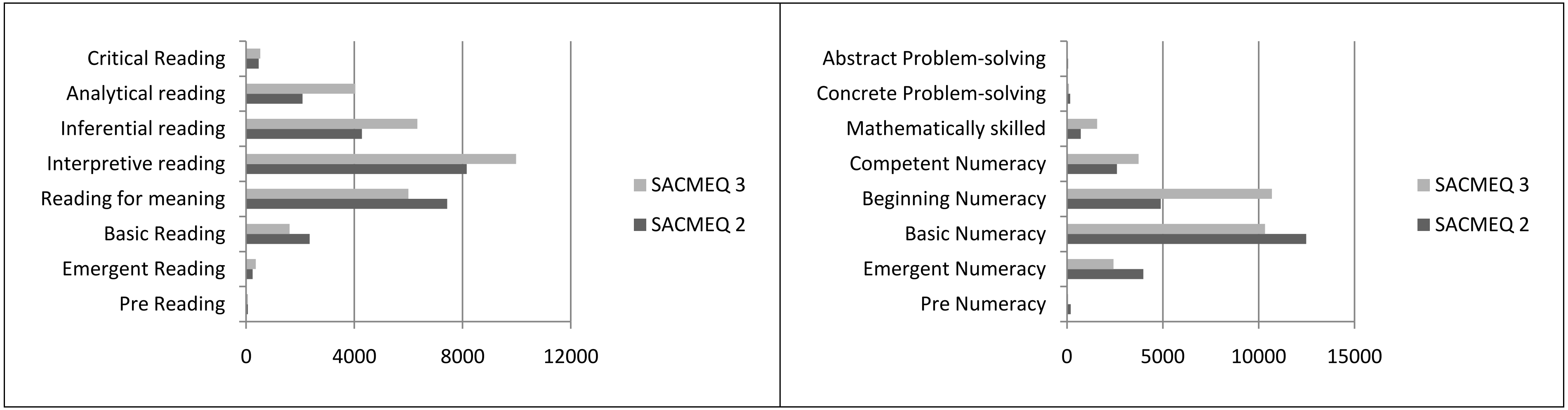


Figure 21: *Numbers of children achieving at various performance levels in literacy and numeracy in Tanzania*

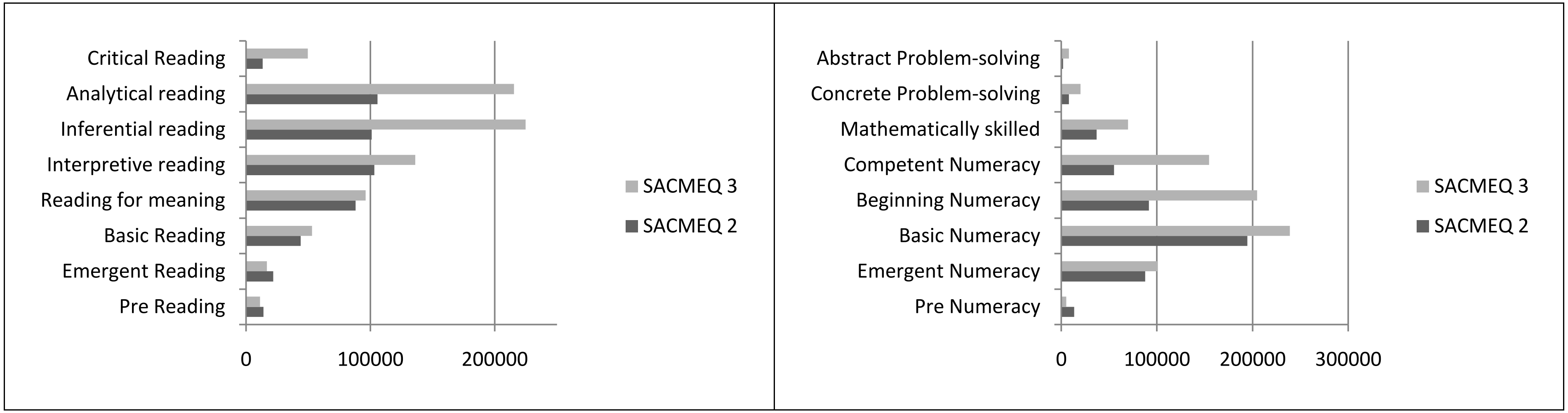


Figure 22: *Numbers of children achieving at various performance levels in literacy and numeracy in Uganda*

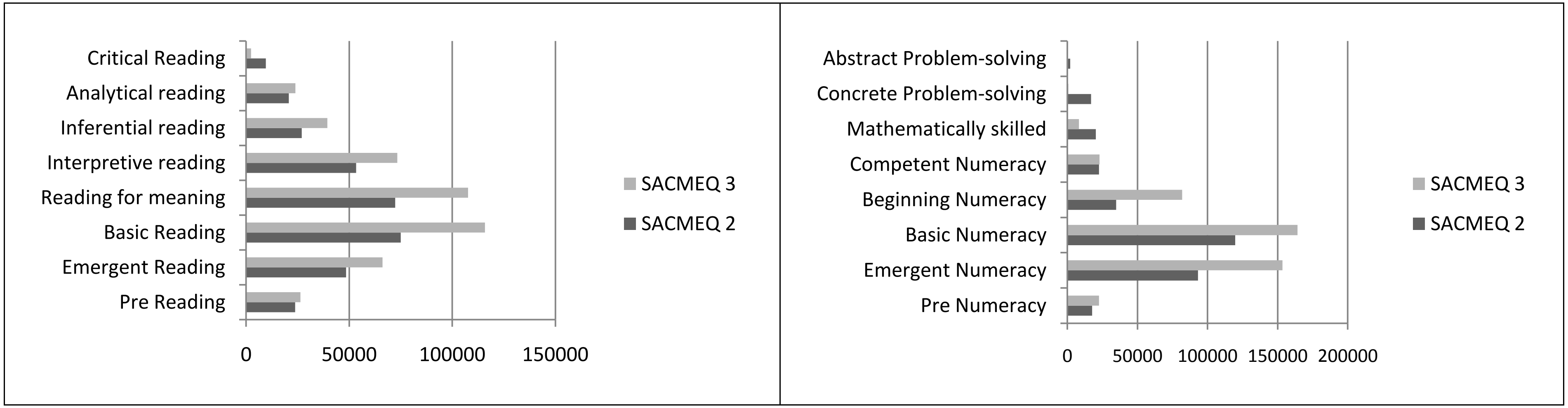
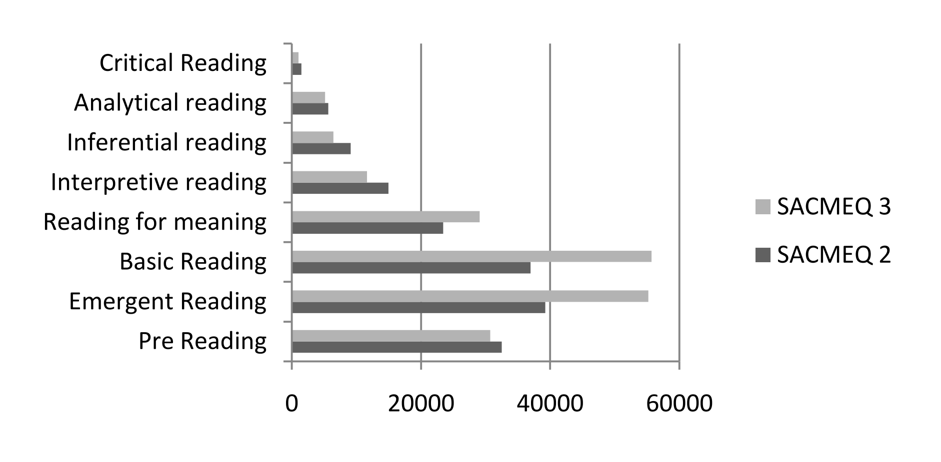


Figure 23: *Numbers of children achieving at various performance levels in literacy and numeracy in Zambia*



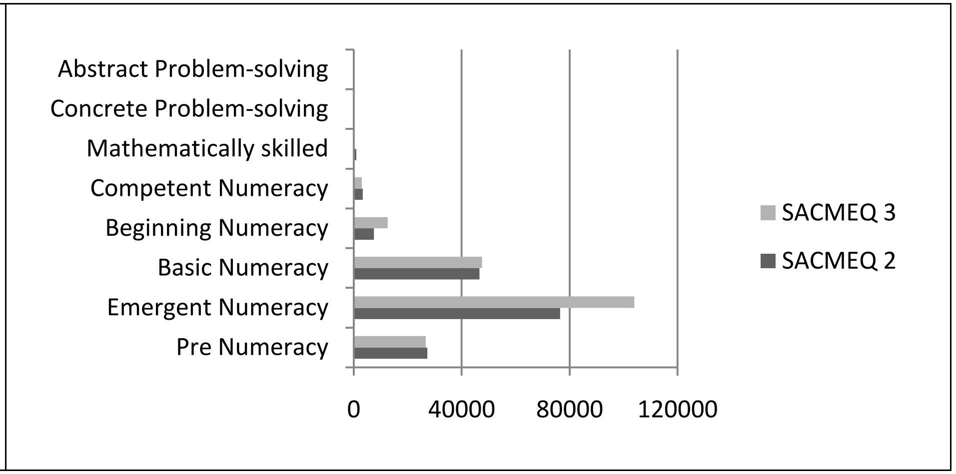


Figure 24: *Numbers of children achieving at various performance levels in literacy and numeracy in Zanzibar*