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Southern and Eastern Africa Consortium for Monitoring Educational Quality

Trends in Achievement Levels of Standard 6 Pupils in Botswana

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Introduction

This policy brief provides information about levels and trends in the reading and mathematics achievements of Standard 6 pupils in Botswana. The results are drawn from two large-scale, cross-national research studies of the quality of education conducted by the fifteen school systems involved in the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ).

Botswana experienced two reviews of its school system. These reviews took place in 1992 and 1996 and were followed by educational reforms that sought to improve the national education system (Keitheile and Mokubung, 2005). Traditionally, the mechanisms for assessing pupils' achievement depended on the implementation of national assessments such as the Standard 7 Primary School Leaving Certificate and the Standard 4 Attainment Test. Other indicators of achievement were observed through international studies such as the IEA literacy study (1989) and the UNESCO Monitoring Learning Achievement (MLA) Study (2000). However, experience has shown that the data from these studies were rarely used to respond to educational concerns such as the reasons that explained important variations in pupil achievement (Masalila, 2006).

Even if the Botswana Ministry of Education did not participate in the SACMEQ I Project (1995), it was found that the policy suggestions produced in the SACMEQ I Project were of paramount importance because issues related to pupils' achievement and conditions of schooling were analysed and discussed. Since the experience from Botswana's neighboring countries proved to be very fruitful, the Ministry of Education decided to join efforts and become an active participant. It was believed that the kind of information and analyses produced during this research study would be critical to guide the Botswana ministry of education in the process of policy making and educational reform supported by the national 'Vision 2016 initiative' (Keitheile and Mokubung, 2005).

In this way, the Botswana Ministry of Education participated in the SACMEQ II (2000) and the SACMEQ III (2007) Projects. Both studies focused on Standard 6 pupils (in 170 schools during 2000 and 160 schools during 2007) and assessed pupils' achievement in mathematics and reading literacy.

SACMEQ's Literacy and Numeracy Indicators

When the SACMEQ Consortium was launched in 1995, the SACMEQ's Governing Board (the SACMEQ Assembly of Ministers) emphasized that the planning of improvements in the quality of education required better indicators of the "literacy" and "numeracy" skills that were being acquired by pupils as they moved through the basic cycles of primary education. These indicators were considered important because they allowed senior decision-makers to assess the performance of school systems, and to provide information that could be used for strategies aimed at improving the quality of education.

The SACMEQ Ministers interpreted the concept of "literacy" as meaning reading comprehension skills that were transmitted through school language and reading instruction programmes. They interpreted "numeracy" as meaning the numerical and mathematical reasoning skills that formed the core of school mathematics programmes. The SACMEQ Ministers wanted their school systems to be judged by the extent to which pupils acquired the knowledge and skills that they were expected to acquire – as specified in official school curricula, textbooks, and teachers' guides.

The SACMEQ Ministers decided that the design of tests for the assessment of pupil achievement in reading and mathematics in the SACMEQ research programme should focus on:

(a) Standard 6 - because (i) they wanted to monitor the "output" of their primary education systems before large numbers of the pupil cohort began to leave

school, and (ii) they considered that assessments held at lower Standard levels would result in distorted results due to the "turbulence" in learning environments that occurred in many schools during the changeover (at around Standards 3 to 4) from the delivery of instruction in local to the official or national languages; and

(b) The National Language of Instruction - because they were concerned that the acquisition of reading and mathematics skills in the national language of instruction was necessary for a successful transition to secondary schooling.

The SACMEQ reading and mathematics tests were developed from a careful analysis of the official school curricula, school syllabi, and textbooks used in both Botswana and other SACMEQ school systems. These tests made it possible to employ Modern Item Response Theory methods to undertake item analyses and test-scoring procedures. The test scores were transformed so that pupils from both the SACMEQ II and III Projects were placed on a single scale with the SACMEQ II scores anchored to a mean of 500 and a standard deviation of 100.

The SACMEQ reading and mathematics tests were scored in two different ways for different reporting purposes:

(a) Scaled Scores – which were useful for reporting the average performance of pupils at national and regional levels for both SACMEQ II and III Projects. These scores were scaled so that meaningful comparisons could be made across countries for each project, and across projects for each country. The average scaled scores for Botswana and its regions have been reported in **Table 1** for the SACMEQ II Project (2000) and the SACMEQ III Project (2007).

(b) Competency (or Skill) Levels – which were useful for presenting a descriptive account of (i) the skills that pupils had acquired at eight levels of competence measured by the scaled scores, and (ii) the skills that must be acquired for pupils to move from one level of competence to a higher level. The competency levels for reading and mathematics have been described in **Table 2(a)** and **Table 2(b)**, respectively. These tables show the percentages of Botswana's pupils at each competency level for the SACMEQ II Project (2000) and the SACMEQ III Project (2007).

Results for Average Scaled Scores

The average reading and mathematics scores of Standard 6 pupils across the 7 regions of Botswana were derived from SACMEQ reading and mathematics tests that were administered in Botswana to 3322 Standard 6 pupils from 170 schools for the SACMEQ II Project in 2000, and 3868 Standard 6 pupils in 160 schools for the SACMEQ III Project in 2007.

In order to examine **levels of achievement**, the average scores were colour-coded to show their levels relative to the SACMEQ II Project overall mean of 500. Green figures indicated ten points or more above the SACMEQ average, red figures indicated ten points or more below the SACMEQ average, and black figures indicated within ten points of the SACMEQ average.

In order to show **trends in achievement,** colour-coded arrowheads were used to show changes in average scores between 2000 and 2007. A green arrowhead denoted an increase of ten points or more, a red arrowhead denoted a decrease of ten points or more, and a grey arrowhead denoted change of less than 10 points above or below the SACMEQ mean of 500.

(a) Achievement Levels

It can be seen from **Table 1** that for Botswana as a whole, the mean score for reading increased by 14 points, from 521 points in 2000 to 535 points in 2007. For mathematics, there was a negligible change of less than 10 points in the national mean score, that is, from 513 points in 2000 to 521 points in 2007.

From the green figures in **Table 1**, it can be seen that most of the regions registered an improvement in performance for both reading and mathematics. The highest improvement in pupils' achievement was registered in the Central North region with an increase of 46 points in the pupils' reading scores and 32 points in the pupils' mathematics scores. However, the only two exceptions were observed in the South Central and Southern regions. The latter registered the highest pupils' decline with a deterioration of 22 points in reading and 14 points in mathematics scores.

(b) Achievement Trends

From the green arrowheads in **Table 1**, it can be seen that the majority of the regions in Botswana registered an improvement in pupils' reading scores. However, the South Central and Southern regions did not follow this pattern. Concerning the mathematics scores, only three regions (Central North, Central South and Gaborone) registered a significant positive trend

between the SACMEQ II and SACMEQ III studies. In the other regions minimal changes of less than 10 points were registered.

Results for Competence Levels

Another way in which the SACMEQ results can be presented is by calculating the percentages of pupils who had reached each level of competence on a hierarchical scale of competence levels as explained below.

The reading and mathematics test items were first arranged in order of difficulty, and then examined item-by-item to describe the specific skills required in order to provide correct responses. Items were then placed in groups so that the items in each group had similar difficulty values and shared a common theme with respect to the underpinning competencies required to provide correct responses.

This "skills audit" for the reading and mathematics tests resulted in the identification of eight hierarchical levels of competence for each test (Level 1 being the lowest, and Level 8 being the highest).

The results of the skills audit have been presented in **Tables 2(a), and 2(b).** A description or summary name was linked with each of the levels – in order to summarize the competencies associated with each group of test items. The first three competence levels in reading and mathematics employed the same prefixes (Pre, Emergent, and Basic) in order to reflect the mechanical nature of the most elementary competencies. From the fourth level upwards, the prefixes of the summary names were different for reading and mathematics, and were designed to reflect deeper levels of understanding of subject specific competencies.

The eight competence levels provided a more concrete analysis of what pupils could actually do. They also suggested instructional strategies relevant to pupils who were learning at each level of competence.

For reading, it can be seen from Table 2(a) that in 2007 the highest percentages of pupils' levels of competence were registered at level 4 (19.2%), level 5 (20.7%), and level 6 (16.5%).

However, between 2000 and 2007 there were decreases in the percentages of pupils who were performing at Levels 3, 4 and 5 as indicated by the minus (-) symbols in front of the figures in the final column of **Table 2(a)**. At the same time it is important to note that the percentages of pupils reaching levels 6, 7 and 8 increased as is denoted by the (+) symbols. These findings represent a good sign for Botswana because the decrease in the percentages of pupils performing at levels 3, 4, and 5 is justified by the increase in the percentage of pupils performing at higher levels of competence (6, 7 and 8) and, therefore, reaching deeper levels of understanding.

For mathematics, **Table 2(b)** showed that in 2007 the highest percentages of pupils' levels of competence were concentrated at Level 2 (20.9%), Level 3 (34.0%), and Level 4 (27.2%).

However, the percentages of pupils who were performing at Levels 1, 2 and 3 decreased in 2007. Here again, the decline in the percentages of pupils performing at these low achievement levels implies an improvement in pupils' competence because a positive change can be observed at Level 4. In other words, in 2007 there were more pupils who were able to translate information into simple arithmetic problems.

Summary of Results

The results discussed in this Policy Brief have shown that an improvement in the performance of Standard 6 pupils was registered in most regions in both reading and mathematics between 2000 and 2007.

The only regions that did not present an improvement were the South Central and the Southern regions. However, it is important to point out that those regions are considered to represent the rural areas in Botswana. Therefore, the disparities in the pupils' performance might be attributed to the fact that in rural areas – where fewer resources are made available – pupils encounter difficulties to perform well at school.

It is relevant to highlight that Botswana's mean score was higher than the SACMEQ mean score in both SACMEQ II and SACMEQ III studies.

Research-Based Conclusions

The following conclusions have been based on the results discussed in this Policy Brief concerning: (a) achievement levels for Standard 6 pupils – as measured by scaled test scores, and (b) achievement trends of Standard 6 pupils – as measured by their location in one of the 8 competency levels.

1. **<u>Levels of Achievement</u>: In 2007 the average reading and mathematics performance of**

Standard 6 pupils in Botswana was above the SACMEQ overall average. However, notable disparities among regions were observed, especially between rural and urban areas.

Education authorities should reinforce their support through the promotion of an active interaction between the Curriculum Development and Evaluation Department and the Teacher Training and Development Department. This would enable decision makers to find ways of improving the quality of reading and mathematics instruction in Botswana's primary schools, especially those located in rural areas.

2. **Trends in Achievement: Between 2000 and 2007 many regions in Botswana experienced an improvement in the average reading and mathematics performances of Standard 6 pupils. The only exceptions were the South Central and Southern regions. It is important to note that the latter registered a noticeable decrease in both subjects.**

   The Ministry of Education and Skills Development should congratulate the teaching force and training institutions for the observed improvements and ensure that opportunities are utilized to continue these positive trends.

A Concluding Comment

The task of improving the quality of education for a whole system of education must be seen as a long-term challenge. There are very few examples in the world where "quick fix" responses have resulted in system-wide positive improvements in the quality of education delivered across a nation.

Overall, it would be possible to suggest that the improvement in pupils achievement levels observed at the national level in 2007 might be interpreted as the result of different successful interventions. One example of this was the support that education officers have provided in terms of monitoring and supervision of schools (E&T SPSP JAA, 2008).

It is worth noting that while it takes decades to improve the quality of education at the country level, all stakeholders in the education sector should continue to make contributions to interventions geared towards a national positive impact. For this reason there is a need to join efforts in order to ensure balance of education quality across all the regions in Botswana.

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A copy of this Policy Brief can be downloaded from the SACMEQ Website: www.sacmeq.org

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Table 1: Levels and Trends in Pupil Achievement across Regions in Botswana

	Pupil reading score			Pupil mathematics score		
	2000	2007		2000	2007	
Central North	506	552	▲	506	538	▲
Central South	499	527	▲	497	514	▲
Gaborone	577	603	▲	543	569	▲
Northern	530	545	▲	512	521	►
South Central	532	524	►	526	513	▼
Southern	523	501	▼	510	496	▼
Western	505	515	▲	506	506	►
BOTSWANA	521	535	▲	513	521	►
SACMEQ	**500**	512	▲	**500**	**510**	►

Values in **Green** = 10 points or more above SACMEQ II mean of 500

Values in **Black** = less than 10 points above or below SACMEQ II mean of 500

Values in **Red** = 10 points or more below SACMEQ II mean of 500

Notes about trend:

▲ Increased by 10 points or more ► Minimal change (less than ±10) ▼ Decreased by 10 points or more

Table 2(a): Percentages of Pupils Reaching Various Levels of Competence in Reading

Reading Skill Levels			2000	2007	Change
Level	**Description**	**Skill/Competence**	%	%	%
1	Pre-reading	Matches words and pictures involving concrete concepts and everyday objects.	2.8	2.9	**+0.1**
2	Emergent Reading	Matches words and pictures involving prepositions and abstract concepts.	7.7	7.7	**0**
3	Basic Reading	Interprets meaning (by matching words and phrases, completing sentences).	15.7	13.6	**-2.1**
4	Reading for Meaning	Reads to link and interpret information located in various parts of the text.	23.0	19.2	**-3.8**
5	Interpretive Reading	Interprets information from various parts of the text in association with external information.	24.1	20.7	**-3.4**
6	Inferential Reading	Reads to combine information from various parts of the text so as to infer the writer's purpose.	14.0	16.5	**+2.5**
7	Analytical Reading	Locates information in longer texts (narrative, document or expository) in order to combine information from various parts of the text so as to infer the writer's personal beliefs (value systems, prejudices and biases).	9.5	13.7	**+4.2**
8	Critical Reading	Reads 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	3.2	5.8	**+2.6**

Table 2(b): Percentages of Pupils Reaching Various Levels of Competence in Mathematics

Mathematics Skill Levels			2000	2007	Change
Level	**Description**	**Skill/Competency**	%	%	%
1	Pre-Numeracy	Applies single step addition and subtraction.	3.3	1.5	**-1.8**
2	Emergent Numeracy	Applies a two-step addition and subtraction involving carrying.	25.8	20.9	**-4.9**
3	Basic Numeracy	Translates verbal information into arithmetic operations.	35.8	34.0	**-1.8**
4	Beginning Numeracy	Translates verbal or graphic information into simple arithmetic problems.	19.6	27.2	**+7.6**
5	Competent Numeracy	Translates verbal, graphic, or tabular information into an arithmetic form in order to solve a given problem.	10.2	9.2	**-1**
6	Mathematically Skilled	Solves multiple-operation problems (using the correct order) involving fractions, ratios, and decimals.	3.8	6.0	**+2.2**
7	Concrete Problem Solving	Extracts and converts information from tables, charts and other symbolic presentations in order to identify, and then solve multi-step problems	1.2	0.9	**-0.3**
8	Abstract Problem Solving	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 a problem.	0.2	0.4	**+0.2**