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

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. **Levels of Achievement:** 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.

**Authors**

Boikhutso Monyaku  
(bmonyaku@gov.bw)

Onkabetse A Mmereki  
(oammereki@gov.bw)

A copy of this Policy Brief can be downloaded from the SACMEQ Website: [www.sacmeq.org](http://www.sacmeq.org)

**References**


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

<table>
<thead>
<tr>
<th></th>
<th>Pupil reading score</th>
<th></th>
<th>Pupil mathematics score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central North</td>
<td>506</td>
<td>552 ▲</td>
<td>506</td>
</tr>
<tr>
<td>Central South</td>
<td>499</td>
<td>527 ▲</td>
<td>497</td>
</tr>
<tr>
<td>Gaborone</td>
<td>577</td>
<td>603 ▲</td>
<td>543</td>
</tr>
<tr>
<td>Northern</td>
<td>530</td>
<td>545 ▲</td>
<td>512</td>
</tr>
<tr>
<td>South Central</td>
<td>532</td>
<td>524 ▲</td>
<td>526</td>
</tr>
<tr>
<td>Southern</td>
<td>523</td>
<td>501 ▼</td>
<td>510</td>
</tr>
<tr>
<td>Western</td>
<td>505</td>
<td>515 ▲</td>
<td>506</td>
</tr>
<tr>
<td>BOTSWANA</td>
<td>521</td>
<td>535 ▲</td>
<td>513</td>
</tr>
<tr>
<td>SACMEQ</td>
<td>500</td>
<td>512 ▲</td>
<td>500</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Skill/Competency</th>
<th>2000</th>
<th>2007</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pre-reading</td>
<td>Matches words and pictures involving concrete concepts and everyday objects.</td>
<td>2.8</td>
<td>2.9</td>
<td>+0.1</td>
</tr>
<tr>
<td>2</td>
<td>Emergent Reading</td>
<td>Matches words and pictures involving prepositions and abstract concepts.</td>
<td>7.7</td>
<td>7.7</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Basic Reading</td>
<td>Interprets meaning (by matching words and phrases, completing sentences).</td>
<td>15.7</td>
<td>13.6</td>
<td>-2.1</td>
</tr>
<tr>
<td>4</td>
<td>Reading for Meaning</td>
<td>Reads to link and interpret information located in various parts of the text.</td>
<td>23.0</td>
<td>19.2</td>
<td>-3.8</td>
</tr>
<tr>
<td>5</td>
<td>Interpretive Reading</td>
<td>Interprets information from various parts of the text in association with external information.</td>
<td>24.1</td>
<td>20.7</td>
<td>-3.4</td>
</tr>
<tr>
<td>6</td>
<td>Inferential Reading</td>
<td>Reads to combine information from various parts of the text so as to infer the writer's purpose.</td>
<td>14.0</td>
<td>16.5</td>
<td>+2.5</td>
</tr>
<tr>
<td>7</td>
<td>Analytical Reading</td>
<td>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).</td>
<td>9.5</td>
<td>13.7</td>
<td>+4.2</td>
</tr>
<tr>
<td>8</td>
<td>Critical Reading</td>
<td>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</td>
<td>3.2</td>
<td>5.8</td>
<td>+2.6</td>
</tr>
</tbody>
</table>

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

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