A Situational Analysis of Basic Literacy and Numeracy at Early Grade Levels in Botswana

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Acknowledgements

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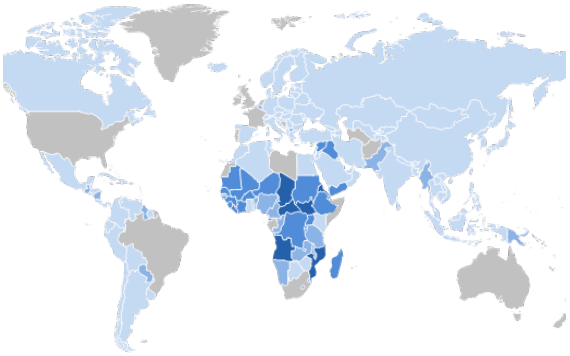
I. Introduction

In recent decades, the global focus on education has been on universal access to primary education. However, as access to education has increased, educators have shifted their focus beyond *access* to education to ensuring a *quality* education for all. To this end, the Sustainable Development Goals (SDGs) expand on the Millennium Development Goals (MDGs) to include an explicit focus on quality education: '*ensure access and quality education for all and promote lifelong learning*' (Goal 4). The *Education for All* initiative and regional bodies, such as the Southern African Development Corporation (SADC), also call for a greater focus on quality education.

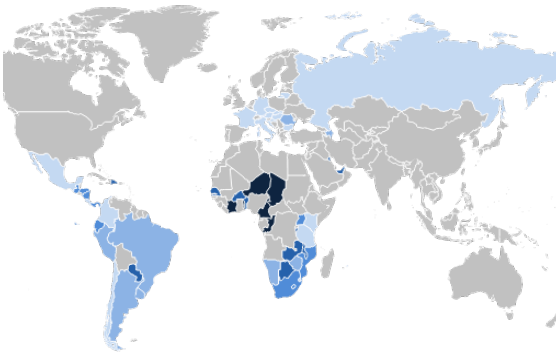
The figures below demonstrate improving enrollment rates worldwide, yet stagnating learning outcomes. The trends highlight the disparity between access and learning. Figure 1.0 shows enrollment rates at the last available data point from 2010-2015. Figure 1.1 shows the percent of pupils achieving minimum proficiency standards by the end of primary school in reading.

Figure 1.0:
Gross Intake Ratio at the Last Grade of Primary School

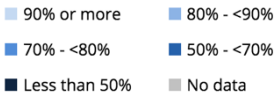


source: UNESCO Institute for Statistics (UIS) 2010-2015

Figure 1.1:
Proportion of youth achieving minimum proficiency standard by end of primary school in reading



source: UNESCO Institute for Statistics (UIS) 2010-2015



Botswana is a prime case study demonstrating the difference in progress between access and quality. According to UNESCO, Botswana had a gross intake ratio in the last year of primary school of 100% in 2013, but only 56% and 61% of students achieved the minimum standard of proficiency in reading and math, respectively, in 2011. While Botswana surpasses its regional neighbors such as Namibia, Zimbabwe, Mozambique and Tanzania in terms of access to education, it trails them on learning outcomes. A closer look at Botswana reveals similar trends over time.

Data from UNESCO demonstrates that between 1970 and 2013, Botswana increased its primary school enrollment rate from below 40% to 100%. Figure 2.0 to the right showcases this trend. While data on learning outcomes is harder to track over time, Figure 2.1 shows that proficiency in reading and math in Botswana was below 90% and 80%, respectively, in 2010, and declined to roughly 55%-60% in each subject by 2011. Thus, not only are learning outcomes not keeping pace with access, they are stagnating and decreasing.

National data confirm this trend. On Botswana's Primary School Leaving Exam (PSLE), the passing rates decreased from 79% in 2005 to 68% in 2009 and the Junior Certificate Exam (JCE) passing rates decreased from 74% in 2011 to 32% in 2013.

The Southern African Consortium for Monitoring Education Quantity (SACMEQ) – a standardized testing regime for learning outcomes conducted in East and Southern Africa headquartered in Botswana - also reveals similar trends.

On a scale of 8 levels of competencies, all of which are supposed to be obtained by the end of primary school, SACMEQ 2007 showed that only 12% of students in Botswana achieved the top 4 competencies in maths, with 88% of students falling in the bottom two quartiles. This implies that 88% of Standard 6 students are at Standard 4 math levels or below. Results from SACMEQ 2013 are forthcoming.

Figure 3.0:

SACMEQ 2007 average competency on a Scale of 1-8

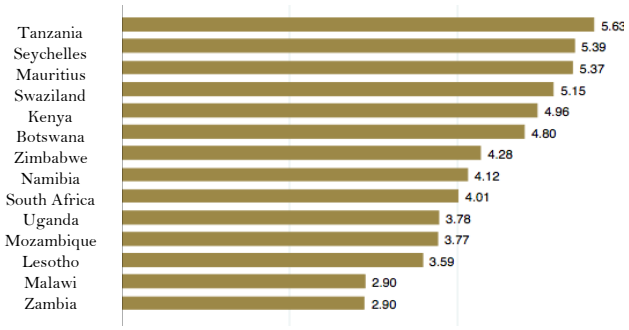


Figure 2.0:

Gross Intake Ratio in the Last Year of Primary School in Botswana, 1970-2013

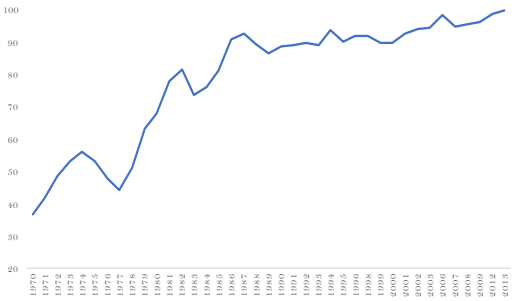


Figure 2.1:

Proportion of youth achieving minimum proficiency standard in math and reading in Botswana, 2010-2011

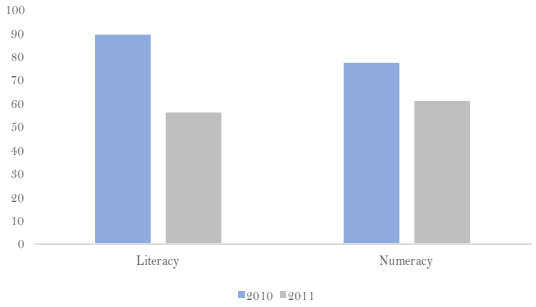


Figure 3.0 to the left shows how Botswana ranks relative to its Eastern and Southern African neighbours. The SACMEQ data reveals similar but slightly different trends from the UNESCO data shown above.

On the SACMEQ assessment, Botswana ranks in the middle of the region. Botswana performs above Mozambique and Namibia, but below Tanzania, Swaziland and Kenya. Botswana, a regional leader in access to education, falls in the middle of the range on learning outcomes.

II. Assessing Early Grade Numeracy and Literacy: A Supplement

There is a need to focus on education quality in Botswana. A series of learning assessments exist to assess learning, such as regional and international assessments including SACMEQ, PISA, TIMMS, PIRLS, and national examinations such as the PSLE.

International assessments provide a strong foundation for regional and global comparison. However, they are conducted at higher grade levels and measure advanced and complex learning concepts in Standard 6. For example, the PIRLS pilot in Botswana in 2011 had a 'flooring' effect, where the scale was too high and did not suit learning levels of a majority of students who were concentrated on the lower end of the scale. Moreover, international assessment scales criss-cross across grade level expectations in Botswana, making it hard to establish direct links to national curricula. Thus, these assessments may be limited in their ability to provide granular understanding of learning by grade level or of attainment of basic learning concepts in early grades.

The PSLE examinations have the advantage of being linked directly to curriculum expectations and are highly context-specific. However, they are administered once-off at the end of primary school in Standard 7, and only provide a snap shot of mastery of complex skills.

Toolkit:

Learning Assessments

International: TIMMS, PISA, PIRLS

Internationally comparable, Sample-based, Complex Skills, Older Primary

Regional: SACMEQ

Regionally comparable, Sample-based, Complex Skills, Older Primary

National: PSLE

Linked to curriculum, Census, Complex Skills, Older Primary

A Supplement:

National: Variation on a CLA

Linked to curriculum, Census, Basic Skills, Early Grade Levels

To this end, there is a need to supplement the PSLE, international and regional assessments with a simple and cost-effective assessment that tests *basic skills* which cover granular knowledge taught in *early grade levels* and is linked directly to the curriculum. Such an assessment might motivate potential early-grade interventions and catch students before they fall behind. We implemented a variation of Community Led Assessments (CLAs), which aim to achieve this goal.

III. The Assessment

The partners for this assessment include: the Botswana Ministry of Basic Education, BERA, the University of Botswana and Young 1ove. We asessed basic literacy and numeracy using two simple 1-page tools with 2,500 students in Chobe and Kgatleng from 13th-24th of March, 2017.

2 regions

47 primary schools

2500 students assessed

The sample was a census of all standard 5 entrants in Kgatleng and Chobe to capture learning achieved by the end of standard 4, which aligned to the highest level in our tools. The regions assessed were selected purposively, as they fall in the middle of the performance distribution in Botswana. Since the assessment is a census, no sampling methodology was needed. We obtained a list of schools in the two selected regions from the Ministry of Basic Education, and verified the list with regional offices and schools directly prior to the assessment. We collected attendance data comparing enrolment rates to the number of students present in the classroom to verify the quality of the census. We find 98.4% attendance in Chobe and 98.9% attendance in Kgatleng.

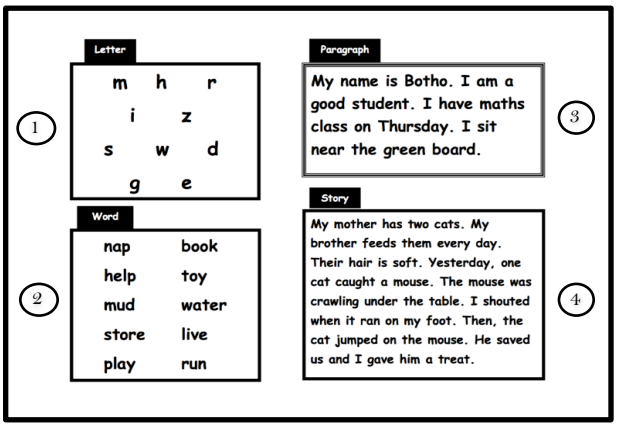
The competencies assessed, basic numeracy and literacy (English), are essential life skills and building blocks for complex learning. Results from this assessment will complement national data, and provide insight into learning at basic levels aligned to national curriculum expectations.

IV. The Methodology

(A) Tools. The literacy and numeracy tools are simple 1-page assessments testing basic numeracy and literacy skills. The assessment was administered verbally in one-on-one interviews with standard 5 entrants. After completing the assessment, students were ranked into a level (1 through 4) according to their demonstrated proficiency.

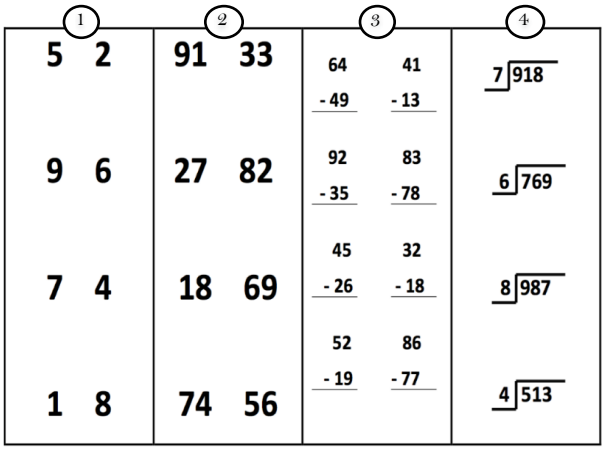
Literacy Tool

levels 1-4



Numeracy Tool

levels 1-4



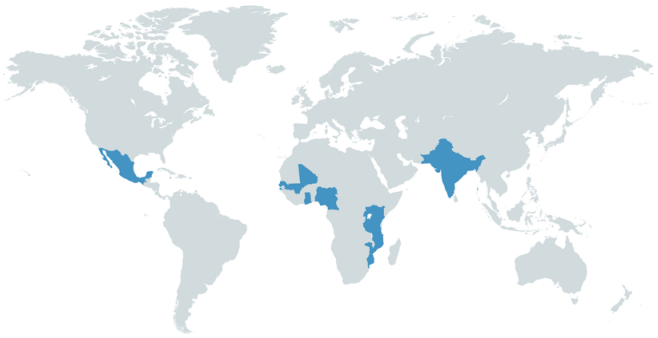
Level	Literacy Level Description
1	Recognize letters of the English alphabet
2	Read short, simple, everyday words
3	Read short sentences fluently, without breaking the flow of the sentence
4	Read a short story fluently, without breaking the flow of the sentences

Numeracy Level Description
Recognize single-digit numbers
Recognize double-digit numbers
Complete double-digit subtraction, which includes one carry-over. This level captures notions of place value and addition
Complete simple long division with remainders. This level encompasses an understanding of place value and incorporates concepts of multiplication

(B) Origin and Adaptation.

Origin of the assessment. The assessment tools used were pioneered in the early 2000s by Pratham, one of the largest NGOs in the world, and the ASER center based in India. In the past 11 years, these assessments, called Citizen Led Assessments (CLAs) have since been conducted in over 10 countries with over 7.5 million students by 600,000 enumerators in over 30 languages. This growth has been stewarded by Pratham, the People's Action for Learning (PAL) network and Uwezo which runs the assessments in Kenya, Tanzania and Uganda.

Figure 4.0: Global Use of Citizen-Led Assessment (CLA)



Adaptation of the assessment to Botswana. In order to adapt the tool to the Botswana context, we aligned the tool to the national curriculum according to the syllabus produced by the Ministry of Education. To this end, the top level of our tool is linked to content expected to be taught by the end of Standard 4. Thus any students who are not at this level by the time we tested them in early Standard 5 would not be considered to be at grade level. We received input from the Ministry of Basic Education Department of Statistics and Planning as well as the Curriculum Department to validate and approve the tools and census methodology. We further piloted the tool with teachers and students, incorporating their input into the final product. Finally, we consulted PAL, Pratham, the Jameel Poverty Action Lab and Uwezo to utilize similar best practices to adapt the foundational tools to the local context.

(C) Reliability and Validity. In order to ensure the tool is valid, we implemented two equivalent versions of the literacy and numeracy assessment tools. These tools were designed to be equivalent and then randomized at delivery, so that any student might take either version. We piloted and reviewed the tool with the Ministry of Basic Education to ensure equivalence and reliability of sorting students into accurate proficiencies. By randomizing equivalent versions of the tool, we can ensure no single question will skew results and we can compare distributions of performance across both version to ensure they are equivalent for reliability and validity tests.

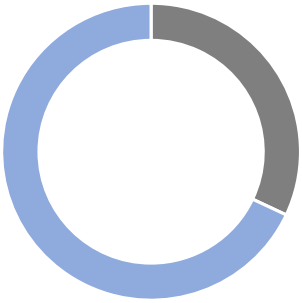
(D) Implementation. We hired and trained 44 surveyors to conduct one-on-one assessments using randomly distributed versions of equivalent numeracy and literacy tools. Once at a school, the order in which each student was assessed was randomized. Students were called from a classroom to a "desk station" outside of the classroom under a tree to ensure students had privacy. This process was repeated with each Standard 5 student in a school. Conducting the assessment took 20 minutes per student. We conducted the assessment with 2,5000 students in Chobe and Kgatleng in roughly 10 working days in March, 2017.

V. Main Results

Note: more detailed results and analysis available upon request

Finding 1: Learning levels are low in both numeracy and literacy

1 in 10 Only 1 in 10 standard 5 entrants could do division

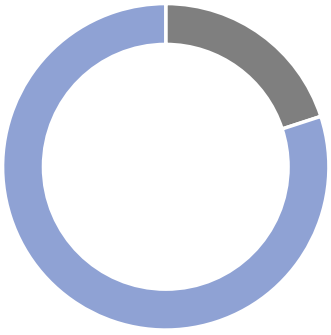


32%

of standard 5 entrants could not do subtraction

Numeracy

6 in 10 Only 6 in 10 standard 5 entrants could read a story



20%

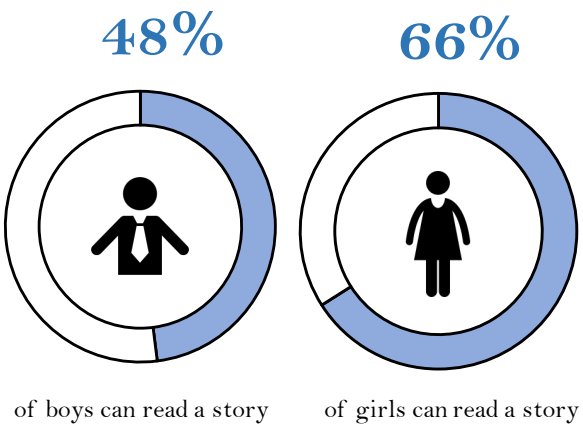
of standard 5 entrants could not read a paragraph

Literacy

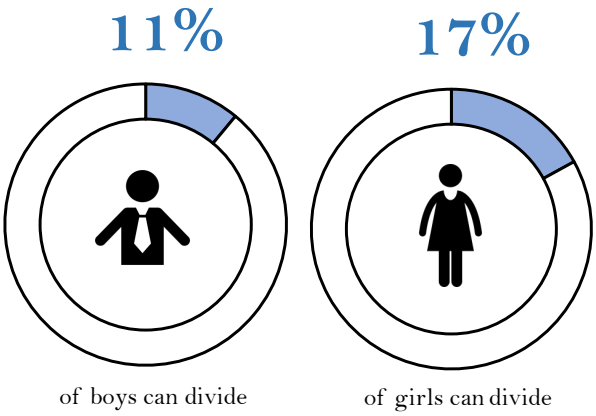
Table 1.0: Percent of Standard 5 Students at Each Level by Subject (%)

	Numeracy	Literacy
Level 1 *can do up to:*	**1%** *recognizing single digits*	**7.1%** *reading letters*
Level 2 *can do up to:*	**31.3%** *recognizing double digits*	**14.4%** reading words
Level 3 *can do up to:*	**53.2%** subtraction	**21.7%** reading a paragraph
Level 4 *can do up to:*	**14.3%** *division*	**56.5%** *reading a story*

Finding 2: Girls do better

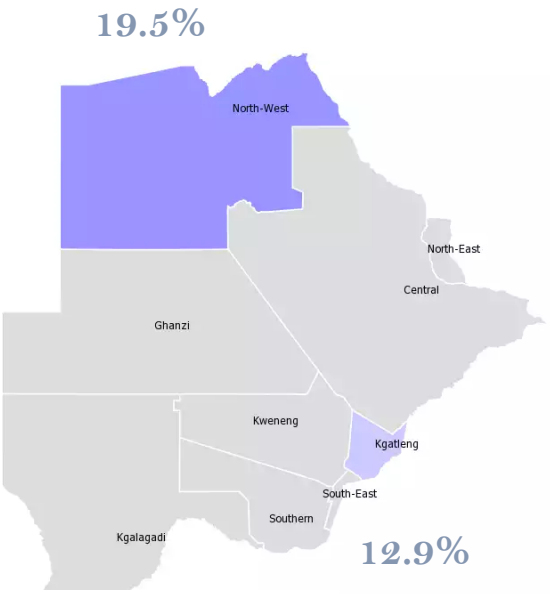


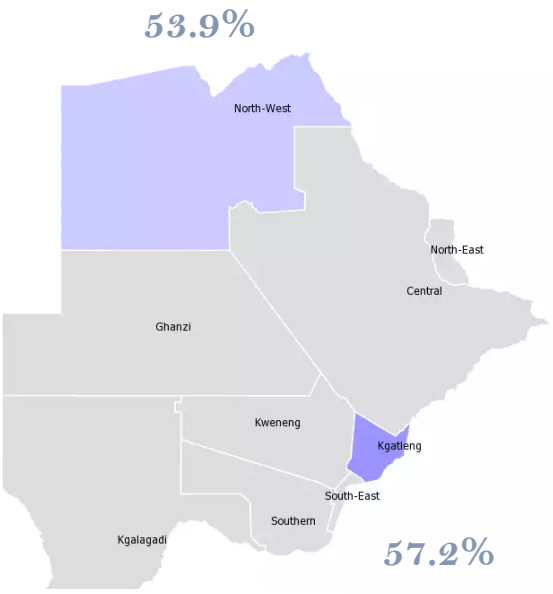
Literacy



Numeracy

Finding 3: Chobe & Kgatleng are similar, with a gap of 4-7 percentage points





can divide **can read a story**

Related Insight: Chobe and Kgatleng represent the country's test score distribution

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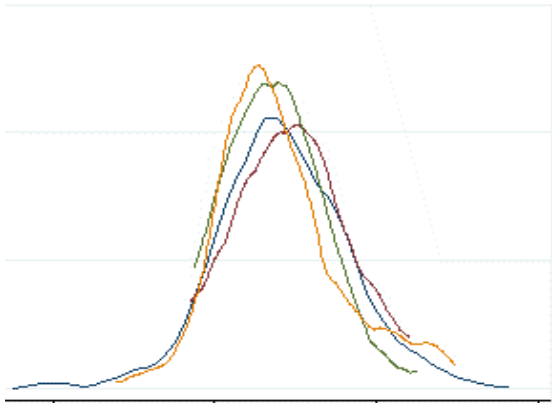
Figure 1.0:

Kernel Density of PSLE scores



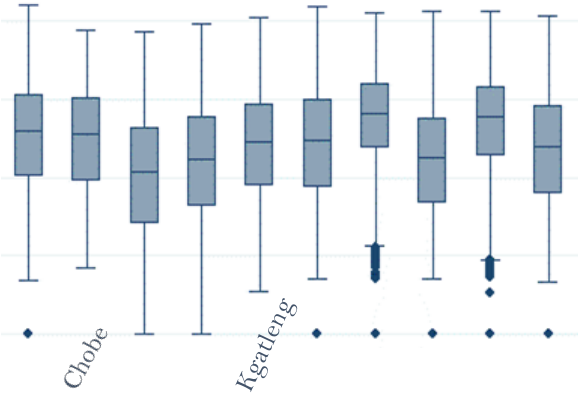
Legend:

Red: Chobe
Green: Kgatleng
Blue: Botswana

Figures 1.0 and 1.1 demonstrate that Chobe and Kgatleng roughly represent other regions in the nation and the nation itself. Moreover Figure 1.1 shows that most variation in performance happens within region rather than across regions. Thus, information from these regions might tell us something about the country.

Figure 1.1

Boxplot - Student PSLE scores by region

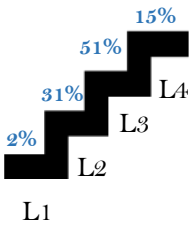


Finding 4: Literacy and Numeracy have only small differences across schools – this suggests significant variation is coming from *within* a school

note: schools are stratified by 4 quartiles of best and worst performing schools according to PSLE scores

Numeracy

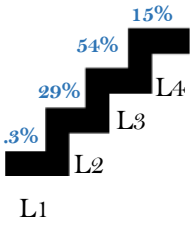
Worst schools (bottom quartile)



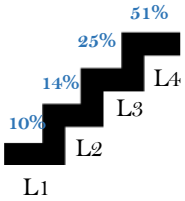
1-3%

Difference between any level between top and worst schools

Best schools (top quartile)



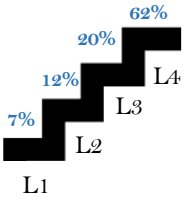
Worst schools (bottom quartile)



2-11%

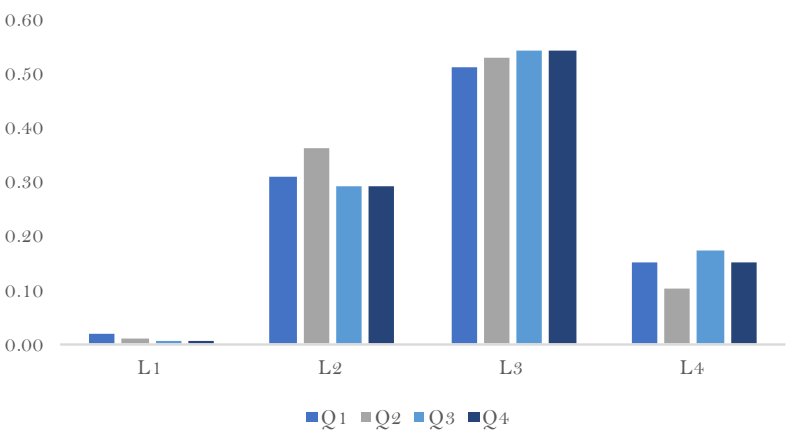
Difference between any level between top and worst schools

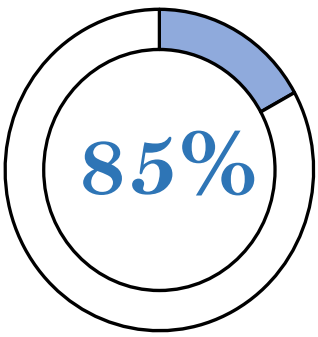
Best schools (top quartile)



Literacy

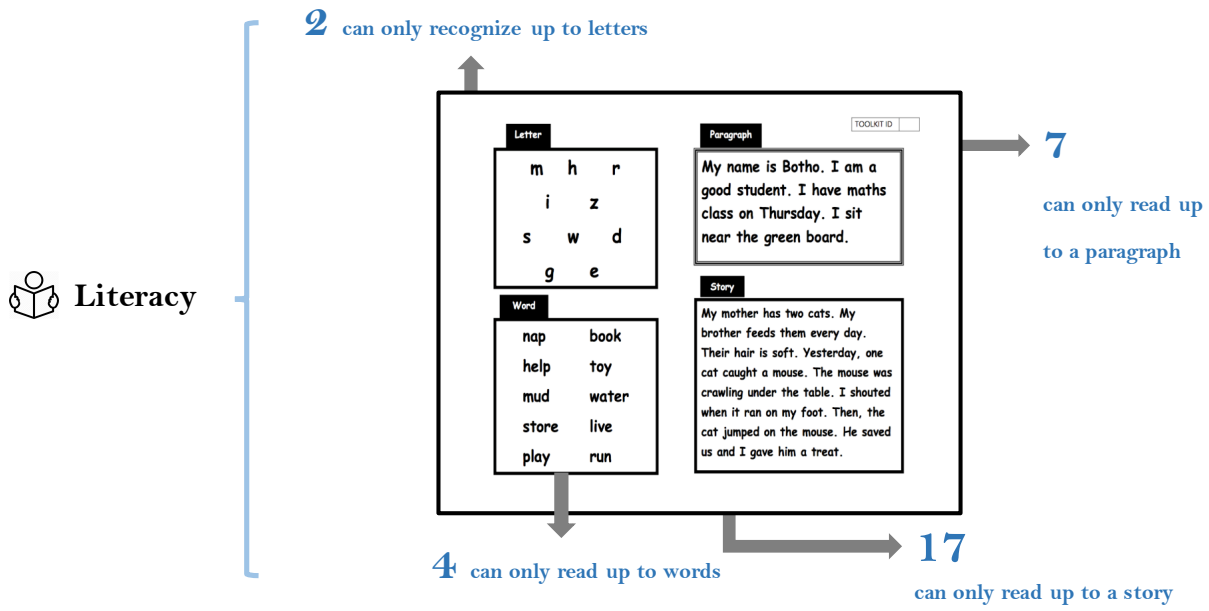
Numeracy
% of students at a given level
by quartile of school performance

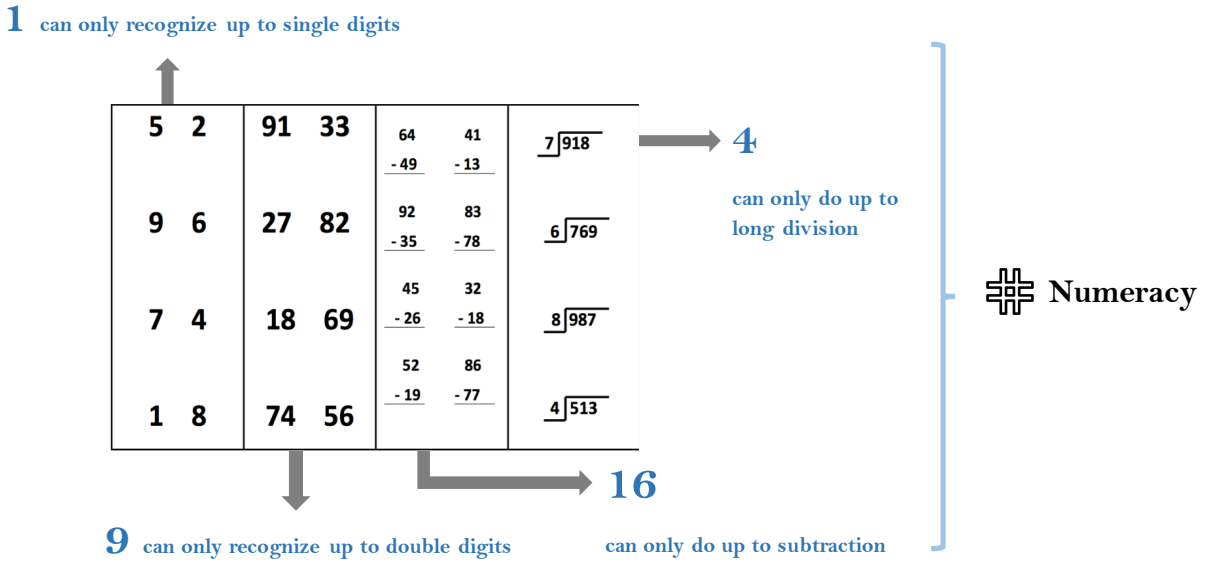




Of standard 5 entrants could not do division in **both** worst and best performing schools

Visualization of Performance Distribution in an Average Class of 30 students





Note: this visualization is meant to demonstrate potential distributions of levels within a classroom. While not a direct statistical extrapolation, it helps demonstrate how the levelling process might look if most of the variation in ability is within school, rather than across schools. Evidence from our assessment's results by different types of schools segmented by quartiles of performance in the PSLE suggest that significant variation in ability is not only across schools, but within schools. This suggests this visualization of levelling within a classroom is indicative of likely levels for an average class.

Summary of Main Results

The main results from the CLA assessment conducted in Botswana reveal a few key findings.

First, learning levels in literacy and numeracy are low. By the time students are in Standard 5, the national curriculum indicates they should know how to divide and read a story. However, only 14.3% of students can divide, and only 56.5% can read a story. This means about half of students are not at grade level in literacy, and over 85% of students are not at grade level in numeracy. Moreover, 32.3% of students cannot subtract – a numeracy skill expected to be acquired by Standard 2 or 3. This indicates that a third of students are lagging two to three years behind by the time they enter standard 5. In literacy, over 20% of students cannot read a paragraph, a skill expected to be acquired at Standard 1 or 2. This indicates that a fifth of students are lagging 3-4 years behind on literacy. Seven percent of students cannot read words.

Second, when disaggregating results, a few additional insights emerge. Girls outperform boys in both literacy and numeracy. Regionally, Chobe and Kgatleng perform similarly. However, slight differences show Chobe outperforms Kgatleng in numeracy, and Kgatleng outperforms Chobe in literacy.

Third, we compare whether variation in performance is a result of variation across schools or within schools. To this end, we segment schools by performance on the CLA based on schools that did well on the PSLE versus schools that did not do well on the PSLE. When we compare the best performing schools (the top quartile) to the worst performing schools (the bottom quartile), the exact same distribution of students, 85%, in both schools cannot divide. Moreover, the difference in scores at each numeracy level is never more than 1 to 3 percentage points. Literacy results see larger variance across high versus low performing schools, with differences across levels ranging from 2 to 11 percentage points. However, even this variance can be interpreted as relatively low. This indicates that significant variation in performance on the assessment is coming from *within* schools, in addition to across schools. We show a potential distribution of performance in a typical class to this effect.

In summary, this assessment shows the performance of basic literacy and numeracy skills expected to be acquired from Standard 1-5. The results reveal a large distribution across these competencies in Standard 5, with large proportions of students below grade level.

VI. Recommendations

(A) Implement a rapid, cost-effective diagnostic of basic learning levels at early grades.

The assessment tool administered provides a rapid and simple indication of a child's current numeracy and literacy proficiency. It allows for categorization and grouping of children according to similar ability levels and can be repeatedly administered to track progress over time.

Teachers and educators can easily administer the tool to gain a real-time granular understanding of their pupils current learning levels. The assessment takes 10-20 minutes per pupil, and requires few materials besides the one-page tool. This might enable students who have fallen behind, to acquire the basic skills and catch up, later developing more complex skills.

(B) Implement a proven remedial education program to support the 53% of students falling behind in literacy, and the 85% of students falling behind in numeracy.

There is a need to implement a remedial education program that catches students who are falling behind, and teaches basic literacy and numeracy so that they can get back on track. The results from this assessment show strong potential for a remedial intervention to have cost-effective impact, particularly for numeracy.

A high potential remedial education program.

The program. A remedial education program called Teaching at the Right Level (TaRL) has been shown to work in over ten trials across three countries (India, Kenya, Ghana).

The program starts with grouping children by kids' learning levels (with a tool similar to the CLA assessment) and teaching level-tailored material with level-tailored activities. Reorienting classroom instruction and tailoring material to a child's current competency means teachers can push high-ability students and also enables students who are behind to catch up. The four key elements of the program are summarized in the graphic below:

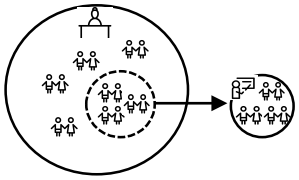
The Curriculum. The program can be delivered over 30 days, in three day bursts of 10 days each, with a short break in between each. Each day the program is delivered for roughly 2 hours. The program can either take place in school or out of school. At the start and end of each 10-day period, students would be "leveled" with an assessment tool to ensure students are sorted into levels that align with their proficiency. Students who learn at a faster pace may advance several levels during the 30-day intervention, while other students may advance one level. Regular assessment allows for optimum student growth. In the attached Appendix, we preent a sample single-day lesson plan, and a 30-day calendar progression for Level 1 Numeracy with two sample activities. In total, there is a menu of over twenty level-targeted activities and materials that can be used once students are leveled.

Potential implementation models. The program has been shown to work across a variety of different models, including the implementer, the location, the timing of the intervention, and the length. To that end, the choice of model is based on cost-effectiveness choice, as well as feasibility, scale and sustainability. Below we propose a long-term model, a short-term proof of concept model, and a pathway from the short-term model to the long-term model.

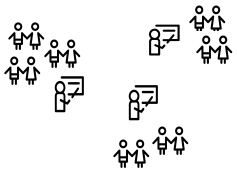
Long-term Model. At end state, TaRL principles could be integrated into mainstream teaching. Government teachers across Botswana could re-organize classroom according to ability and use targeted activities. This would be sustainable, and have cost-effective impact at scale.

Short-Term Proof of Concept: A Snapshot of Two Potential Models

Model 1: Tutors remediate students falling behind outside of class during school hours. Sessions take place in for 10 days, 2 hours a day, three times a year.



Model 2: Tutors run level-targeted camps for all pupils for 10 days for 1 hour after school, three times a year.



Potential Next Steps: Pathway from short-term model to long-term model.

To build towards the long-term model, we propose a 3-staged approach.

Phase I: Pilot Demonstration Model. The end state vision at national scale will take time to build support and implementation systems for. Until then, Young 1ove can pilot a demonstration model. This will enable immediate impact and proof of concept as we work with the Ministry of Education to design an ideal model for scale throughout the country. We propose to focus first on basic numeracy in the pilot model as this is where our assessment demonstrated the most pressing need. Moreover, this approach complements the Ministry of Education and other CSO's existing remedial education efforts which are concentrated in literacy, leaving a numeracy gap. This first implementation phase would take place in schools in Kgatleng, one of the regions in our assessment. We hope to work with government and teachers to identify which of the two pilot short-term models above would be preferable: balancing impact, cost and practical considerations. Young 1ove could then train and support tutors.

Phase II: Fusion 'path to scale' model in collaboration with a government delivery arm. We aim to build a 'path to scale', by exploring a collaboration with government-sponsored implementers such as Tirelo Sechaba volunteers and potentially teachers. The pilots would focus on numeracy, for the reasons listed in Phase I, and take place in both Kgatleng and Chobe, both regions in this assessment. A phased geographical roll-out would allow us to learn and work together to improve the implementation model and to maximize impact.

Phase III: Scale nationally in Botswana with Ministries. This phase would expand the model found to work best in Phase II to the entire nation, also potentially expanding to include literacy and numeracy. Lessons learned from Phase I to III could be integrated with government teachers in the national system as we work converge towards the long-term model.

VI I. Conclusion

In conclusion, this report documents the findings from a Community Led Assessment (CLA) on basic literacy and numeracy for early grade level competencies in Primary School in Botswana. The assessment was conducted as a census of all Standard 5 students in two purposively selected regions in Botswana: Kgatleng and Chobe.

The results show that basic literacy and numeracy are low, with 54% of students below grade level in literacy and 85% of students below grade level in numeracy. In particular, 54% of students could not read a short story, and 85% of students could not do long division. Moreover, between 20% to 33% could not read a paragraph or do subtraction, respectively. To this end, this is a need for early-grade level remediation.

Two main recommendations emerge from this report. First, consideration of using rapid, cost-effective diagnostic tools to assess basic literacy and numeracy at early grade levels so teachers and educators can support students before they fall behind.

Second, implementing a remedial education program, such as Teaching at the Right Level. This could occur in a 3-phased approach, first working in Kgatleng in a collaborative proof of concept, then building a path towards scale in the coming one to two years piloting various scale models, and then scaling-up the best model nation-wide.

In the short-term model, this program can enable the average standard 4 student to meet curriculum expectations for 70-470 BWP per child depending on the model. In the long-term, the average child can be boosted to right below curriculum expectations for 77 BWP per child.

Appendix

Example Daily Lesson Plan

- **Time**: 60 minutes
- **Level:** 1
- **Subject**: Numeracy
- **Topic:** Numbers
- **Lesson Objectives:** Recognize numbers between 1-99


Number chart, student booklet, bundle sticks (straws/sticks and rubber bands)

(1) Activity: Single-Digit Numbers Aloud

Facilitator reads aloud single-digit numbers on the number chart as learners listen on. After reading a number, invite students to assign the number a gesture or dance move. When reading numbers, facilitator performs gesture.

After going through a few, students read numbers aloud and perform appropriate gestures and dance moves.

10 minutes

(2) Activity: Practice Single-Digit Number Aloud

In smaller groups of 5 – 6, student repeat the Number Aloud by taking turns to point to number on the number chart, perform gestures and asking each other to read aloud.

10 minutes

(3) Activity: Bundle Stick Counting

In a large group, facilitator picks up a fistful of sticks and uses them to count aloud to students. Students count 10 sticks and tie them with a rubber band and make a bundle (10 sticks = a bundle,1 bundle = 10 sticks). Facilitator draws a table for bundles and sticks, places bundles in bundle column and sticks in sticks column and writes the number in the appropriate column.

Time: 15 minutes

(4) Activity: Practice Bundle Stick Counting

Students repeat the above activity in small groups of 5 – 6, helping each other learn the concepts by taking turns choosing a certain number of bundles and sticks, writing in the table and counting aloud.

15 minutes

(5) Activity: Number Writing Practice

Students practice writing numbers 1 – 99 in their notebooks. Facilitator assists student individually.

10 minutes

Example Intervention Calendar: Numeracy Level 1 → Level 2

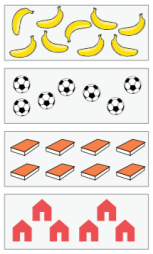
Objective: Compare single and double-digit numbers and recognize place value.

Week	Monday	Tuesday	Wednesday	Thursday	Friday
1	Leveling	Number Recognition [1 – 9]			
2	Number Recognition [1 – 9]				Leveling
3	Leveling	Place Value [0 – 99]			
4	Place Value [0 – 99] + Number Comparison				Leveling
5	Leveling	Number Recognition [0 – 99] + Number Comparison			
6	Intro to Operation Symbols [+, -, =]				Leveling

SampleActivity: Comparing Objects
[*Number Comparison*]

Objects are placed in groups on the floor or drawn on the chalk board. Students tick the box next to the objects with greater or fewer items, as instructed.

Sample Activity: Picture Matching
[*Number Recognition*]



Students count object on each card and match the picture cards with written numbers. Can be played as a game