Preparing teachers to teach Mathematics and Science in African secondary schools

Drawing on evidence from: Lesotho, Eritrea, The Gambia, Liberia, Malawi, Uganda, Zambia and Zanzibar

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The supply of mathematics and science teachers

• Most countries have a shortage of qualified mathematics and science teachers
  – **The Gambia:** 38% of upper basic school teachers are qualified in SES, but only 17% in mathematics, and 18% in English
  – **Lesotho:** one school reported that they typically received 20-30 applications for a humanities post, but only one for a math post.

• Most are training fewer teachers of mathematics and science than other subjects
  – **In Lesotho** only 8% of the students in LCE are studying mathematics, compared with 47% studying English.
  – **In Uganda** only 19% of students in NTCs are studying mathematics.
This problem is getting worse....

• With expansion, primary teachers are teaching at secondary level.
  – **Eritrea**: most middle school teachers in government schools (66%) are only qualified at the elementary level.
  – **Malawi**: 61.5% of secondary teachers are actually primary teachers who have transferred to secondary schools.

• Attrition of mathematics and science teachers is higher
  – The greatest cause of attrition is resignation, not retirement.
  – Attrition of secondary teachers is higher than primary.
  – Anecdotally, higher losses of mathematics and science teachers
Need to monitor and plan supply

Need for a differentiated view of teacher supply for secondary teachers
A vicious cycle

Shortage of good mathematics and science teachers

Few school leavers with good mathematics and science to enter teacher training

Poor mathematics and science at primary school

Poor mathematics and science at secondary school
The vicious cycle

• Primary teachers with poor math and science skills

• Students enter secondary school with poor understanding and attitudes
  – Avoid mathematics and science if they can.

• Secondary teachers often unqualified

• Very limited output of school leavers with math and science
  – Highly valued in the labor market
  – Few available to enter teacher training. In Lesotho, Zanzibar, The Gambia, they are unable to fill the spaces in mathematics and science teacher training, because of insufficient applicants.
Breaking the cycle – some possibilities

• Train more mathematics and science teachers
  – More places in training colleges
  – Adjusting entry requirements to allow more to enter

• Less reliance on graduates who specialize in education
  – Train more teachers at diploma level
  – Recruit graduates who did more general degrees.

• Booster courses
  – Design booster courses to improve the basic mathematics and science skills, before they enter teacher training.

• Long term
  – In-service training for primary and secondary teachers, quality reforms, magnet schools, and science camps.
The supply problem cannot be solved without addressing the distribution problem
Uneven deployment

• Hardship areas (usually remote rural areas) have
  – Fewer qualified teachers
  – Fewer graduate teachers
  – Fewer mathematics and science teachers
  – Fewer female teachers

• Examples
  – Malawi: Kasungu district, twenty graduates from Mzuzu University were sent to rural schools, but only two or three stayed.

  – Uganda: In Kampala, 60% of secondary teachers are graduates, while in Yumbe and Pader only 11% are graduates. Some secondary schools have no qualified mathematics teacher.

  – Zambia: Shangombo, a very rural district in Southern Province, reported that they did not have a single applicant with a degree.

  – Zanzibar: Micheweni district, only 2 qualified mathematics teachers, 1,900 students each
Who will teach in a remote rural school?

- Not likely to be:
  - From an elite family or from an elite school.
  - From the biggest urban areas
  - The top achievers in mathematics and science

- More likely to be
  - People from the area, or from a similar rural area
  - Middle-achievers (diploma holders)
Distribution problem – some ideas

- **Self-selection**
  - Lesotho schools advertise, most posts are filled.
  - Uganda, Zambia, increasing use of advertising posts in specific places.

- **Incentives**
  - Cash incentives
  - Career incentives

- **Selecting the right people into teacher training**
  - More from rural areas,
  - Making rural posting a condition.
Need to review the way we prepare teachers.
Grade 6 in a Community school Liberia

\[ \frac{936}{\phantom{000}213} = \frac{723}{\phantom{00}723} \]

\[ y^2 + 3 + 5 \]

\[ 7 + 3 \]

\[ (3^3) + 3 + 4 \]

\[ y = 13 \]
Dominance of transcription

15

**SCALE**

A scale of a map is a ratio between the distance on the map and that on the ground.

Scale may be grouped as Large Scale, Medium Scale, and Small Scale. The choice of a scale to use depends on the purpose of the map, the detail to be shown, and the size of the paper.

Large-scale maps are used to present small areas and many details are shown. For example, a map of a village, farm, estate, or building would use large scales. The map size includes the following scales: 1:25,000, 1:10,000, 1:5,000.

Medium-scale maps are used to present medium areas with medium details. Examples are a map of a diastatic region and a city would use medium scales. The map scales include the following scales: 1:50,000, 1:100,000, 1:125,000.

Small-scale maps are used to present information of a large area. This type of scale covers a big area.
Mathematics and science are different.

Subjects which depend on understanding.

Content is incremental – failure to understand one part blocks understanding of subsequent parts.
What kind of teacher training?

• Traditional teacher training
  – Assumes student teachers understand school level content
  – Provides more advanced content
  – Provides principles of pedagogy

• We cannot assume mastery of school level
  – Low scores on entry to teacher training
  – Taught by memorization, limited UNDERSTANDING

• Need to adjust teacher training to the reality
  – Re-teach school level content to ensure real understanding
  – Provide the skills to teach with understanding
  – Test for understanding (at end of teacher training).
Summary: Three sets of ideas

• Supply
  – Active planning for supply
  – Train more M+S teachers, especially at diploma level, even if this means lower entry standards.

• Deployment
  – Self selection
  – Incentives (financial and career)
  – Target recruitment into teacher training.

• Quality of teaching
  – Focus on understanding of school level content, and skills to teach for understanding.