LEARNING FROM SUCCESSFUL EARLY-GRADE MATH PROGRAMS:
Lessons from the Numeracy at Scale study

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Photo credit: ESMATE
INTRODUCTION TO NUMERACY AT SCALE

- **Goal:** Examine successful programs to provide evidence-based strategies for improving instruction and learning outcomes
- **Approach:** Identify programs that have evidence of impact on numeracy and work at scale.
Research questions:

1. **RQ1**: What classroom ingredients (such as teaching practices and classroom environment) lead to learning in programs that are effective at scale?

2. **RQ2**: What methods of training and support lead to teachers adopting effective classroom practices?

3. **RQ3**: What system-level support is required to deliver effective training and support to teachers and to promote effective classroom practices?
NUMERACY AT SCALE RESEARCH METHODOLOGY: DESIGN

Quantitative:
- 80–130 schools per country
- In each school:
  - Math lessons observed
  - Interviews of teachers, head teachers, trainers, teacher meeting facilitators, and/or coaches
  - Mathematical Knowledge for Teaching survey

Qualitative:
- 10 schools (subsample)
- In each school:
  - Math lessons observed for 3 days
  - Open-ended interviews of teachers
  - Cognitive interviews with students
- Semi-structured interviews with program staff and Ministry of Education officials, including those responsible for teacher training, school supervision, and curriculum and materials
Theme 1: Use of multiple representations.

Teachers:
- use **multiple representations** (concrete materials, pictures, symbols).
  - Explicitly link representations

Data source: Qualitative Observations
Theme 1: Use of multiple representations.

- Teachers ensure that students use the concrete materials and other models themselves.

Who use materials during independent or groupwork?

Data source: Quantitative Observations
Theme 1: Use of multiple representations.

Students use concrete and pictorial representations when solving problems

Percentage of students who used counters, drawings, or fingers to solve the problem.

<table>
<thead>
<tr>
<th></th>
<th>ESMATE (El Salvador)</th>
<th>RAMP (Jordan)</th>
<th>TAFITA (Madagascar)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple addition (13 + 6)</td>
<td>76%</td>
<td>47%</td>
<td>64%</td>
</tr>
<tr>
<td>Simple subtraction (16 - 4)</td>
<td>59%</td>
<td>42%</td>
<td>68%</td>
</tr>
<tr>
<td>Complex addition (38 + 26)</td>
<td>32%</td>
<td>9%</td>
<td>59%</td>
</tr>
<tr>
<td>Complex subtraction (52 - 37)</td>
<td>18%</td>
<td>4%</td>
<td>52%</td>
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</table>

Student Responses from ESMATE

13 + 6
Can you tell me how you solved the problem?

ID32: I counted the total of both groups of counters, one by one.

ID40: I counted 13 counters and here I counted 6. Then I continued counting: 14, 15, 16, 17, 18 and 19.

ID28: First I said 13, then I counted 14, 15, 16, 16, 18, 19 using my fingers.
Theme 2: Focus on understanding.

Teachers ensure that there is a focus on conceptual understanding and procedural fluency by:

- **asking questions** for which there is **more than one right answer**.
- responding to a student who gave incorrect answers by helping them reach the correct solution or discuss why the answer was incorrect.
- Encouraging students to use multiple strategies and in some cases to discuss their mathematical ideas.
KEY FINDINGS – RQ1: *What teaching practices lead to learning?*

**Theme 2: Focus on understanding.**

Teachers ensure that there is a focus on conceptual understanding and procedural fluency by:

- **Making connections between math concepts and the real world or students' experiences.**

![Percent of lessons where teacher connects math concepts to real-life examples or lives of students.](https://example.com/data-source)

*Data source: Quantitative Observations*
Theme 3: Active student engagement

Teachers ensure that all students are engaged and have opportunities to participate actively by:

- Using a variety of questioning techniques
Theme 3: Active student engagement

Teachers ensure that all students are engaged and have opportunities to participate actively by:

- Providing dedicated time for independent and group work

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<th>GKA (India)</th>
<th>ESMATE (El Salvador)</th>
<th>RAMP (Jordan)</th>
<th>R-Maths (South Africa)</th>
<th>TAFITA(^{10}) (Madagascar)</th>
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</thead>
<tbody>
<tr>
<td>Percent of lessons</td>
<td>58%</td>
<td>86%</td>
<td>61%</td>
<td>78%</td>
<td>57%</td>
</tr>
<tr>
<td>(frequency)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Average time</td>
<td>10</td>
<td>19</td>
<td>10</td>
<td>18</td>
<td>11</td>
</tr>
<tr>
<td>(duration, in minutes)</td>
<td></td>
<td></td>
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<tr>
<td>Average % of total</td>
<td>25%</td>
<td>43%</td>
<td>29%</td>
<td>40%</td>
<td>27%</td>
</tr>
<tr>
<td>class time</td>
<td></td>
<td></td>
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</table>
Theme 3: Active student engagement

Teachers ensure that all students are **engaged** and have opportunities to **participate actively** by:

- Ensuring **independent and groupwork is spent in active learning**
Theme 4: Assessment-informed instruction.

Teacher use formal and informal assessment to inform instruction by:

- Monitoring students while they work and helping students who appeared to be struggling.
- Using informal or formal assessment to group and instruct students at their level in some programs, but not all
- More work is needed
Focus on math content and improving instruction.

Emphasis on modeling, practice, and discussion.

Materials provide guidance for instruction

Ongoing support emphasizes feedback, problem solving, and learning new content.

RQ2 Key Findings:
Having concrete materials is important – HOW they are used is equally important.

No one prescribed way to build conceptual understanding and procedural fluency – but one of most important components of instruction.

There are multiple possible pathways for building student engagement – helping teachers to increase and ensure engagement is essential.

More work is needed so teachers can use assessment information to adjust or differentiate their instruction.
Read more about the Numeracy at Scale study at https://learningatscale.net/numeracy-findings/.

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