

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

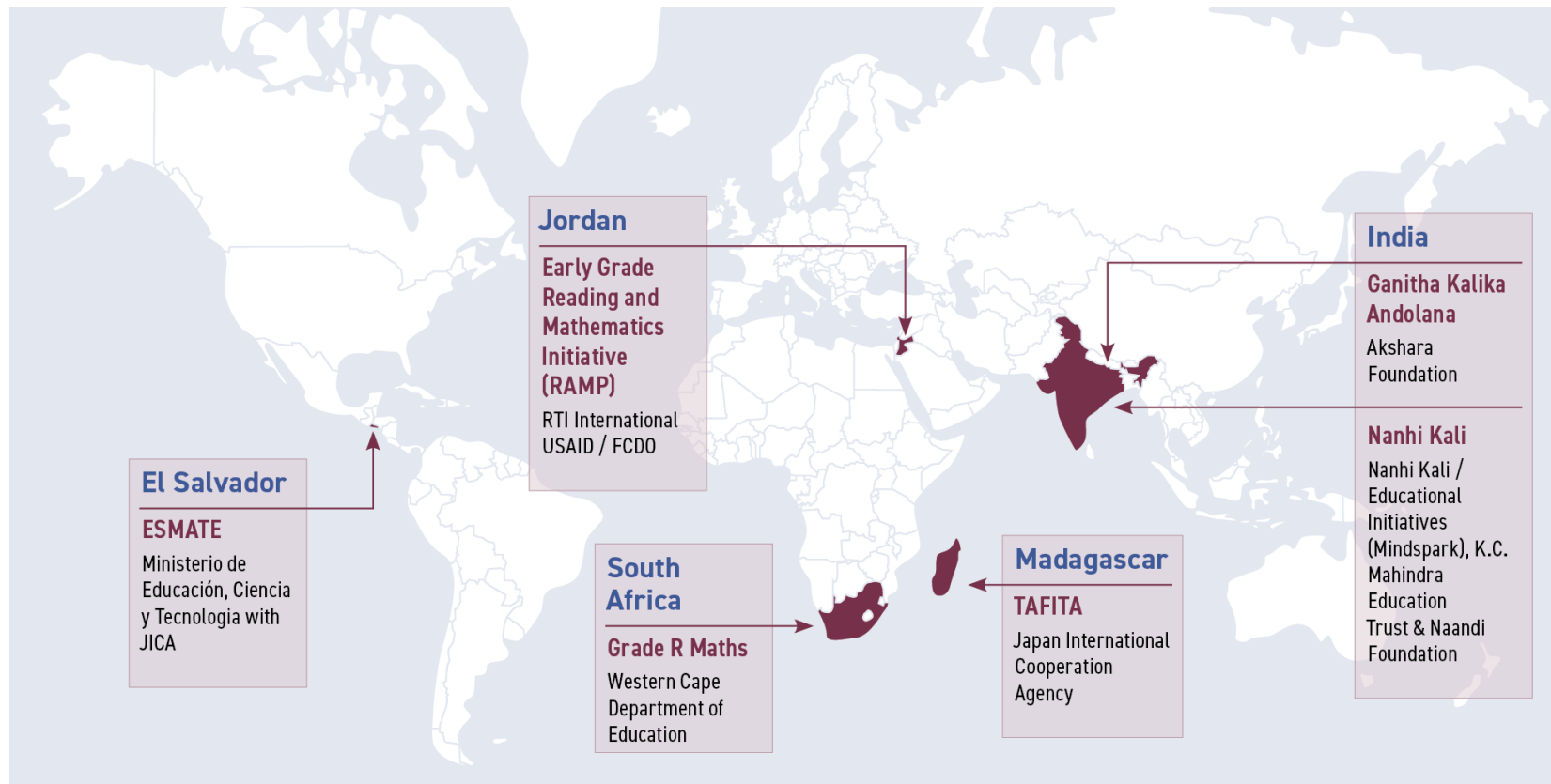
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Photo credit: ESMATE

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 survey¹



Qualitative:

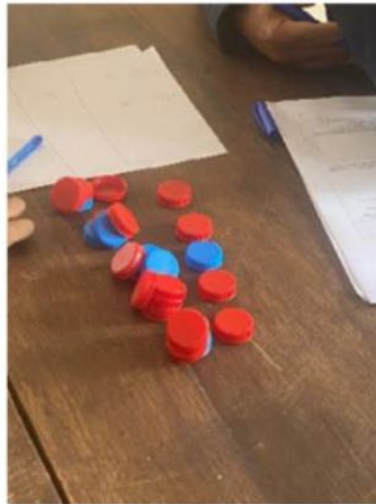
- ▶ 10 schools (subsample)
- ▶ In each school:
 - Math lessons observed for 3 days
 - Open-ended interviews of teachers
 - Cognitive interviews with students
- ▶ Semi-structured interviews with program staff and Ministry of Education officials, including those responsible for teacher training, school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

KEY FINDINGS FROM RQ1: *What instructional strategies lead to learning?*

Theme 1: Use of multiple representations.

Teachers:

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



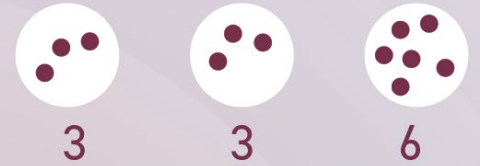
The teacher says ▶

Here are 3 seeds (showing seeds to learners). Here are 3 more. If I put these seeds together, how many are there?

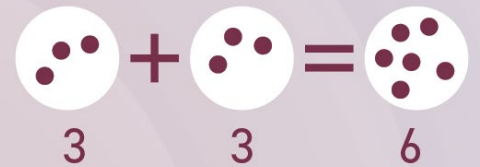
Learner answers ▶

6 seeds.

Teacher draws on board ▶



Then teacher writes and says ▶

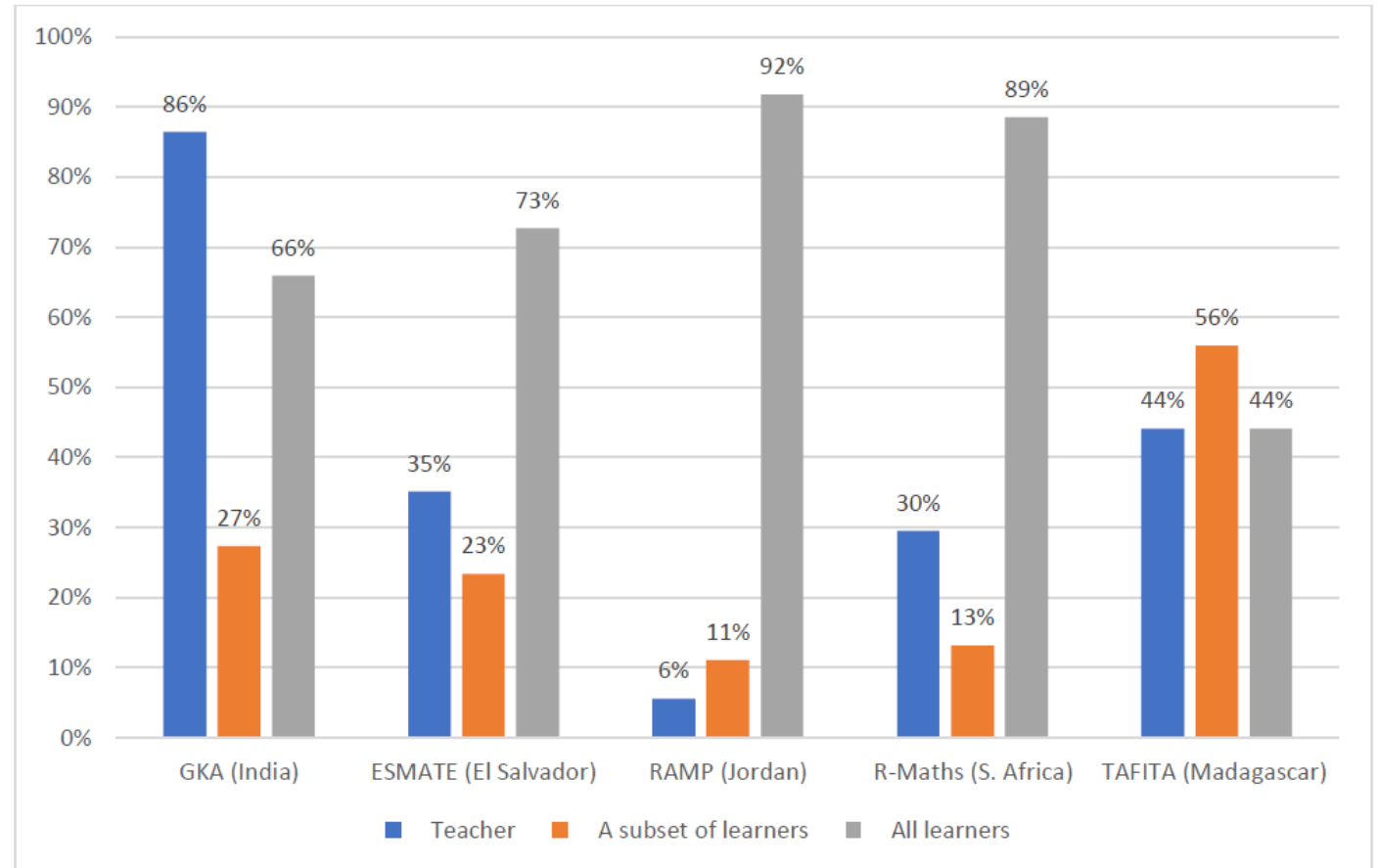


To show we are putting the seeds together, we insert the symbol +, and to show the result, we write =

KEY FINDINGS FROM RQ1: *What instructional strategies lead to learning?*

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?

KEY FINDINGS FROM RQ1: *What instructional strategies lead to learning?*

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.

	ESMATE (El Salvador)	RAMP (Jordan)	TAFITA (Madagascar)
Simple addition (13 + 6)	76%	47%	64%
Simple subtraction (16 - 4)	59%	42%	68%
Complex addition (38 + 26)	32%	9%	59%
Complex subtraction (52 - 37)	18%	4%	52%

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.

KEY FINDINGS – RQ1: *What teachings practices lead to learning?*

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**.

When assigning a set of problems for independent practice, the teacher said,

Each of you can solve it in your own way.

While students were working, she observed

You are wonderful, I can see different ways to solve this question.

And after having some students show their solutions on the board, she remarked,

Some of you solved it through drawing, some solved directly, some solved through repeated subtraction, and some of the students linked division to multiplication. You are wonderful.

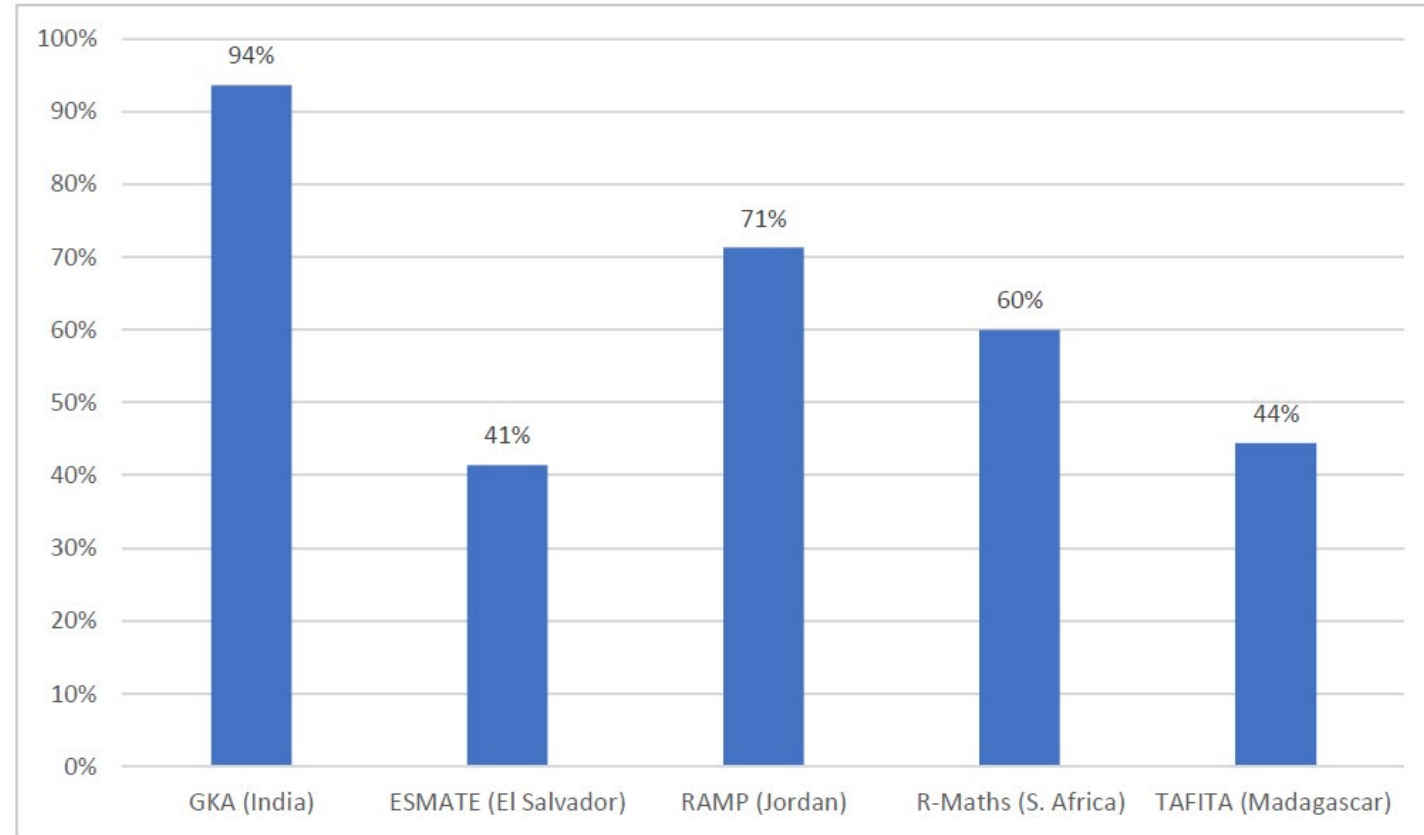


KEY FINDINGS – RQ1: *What teachings practices lead to learning?*

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.**



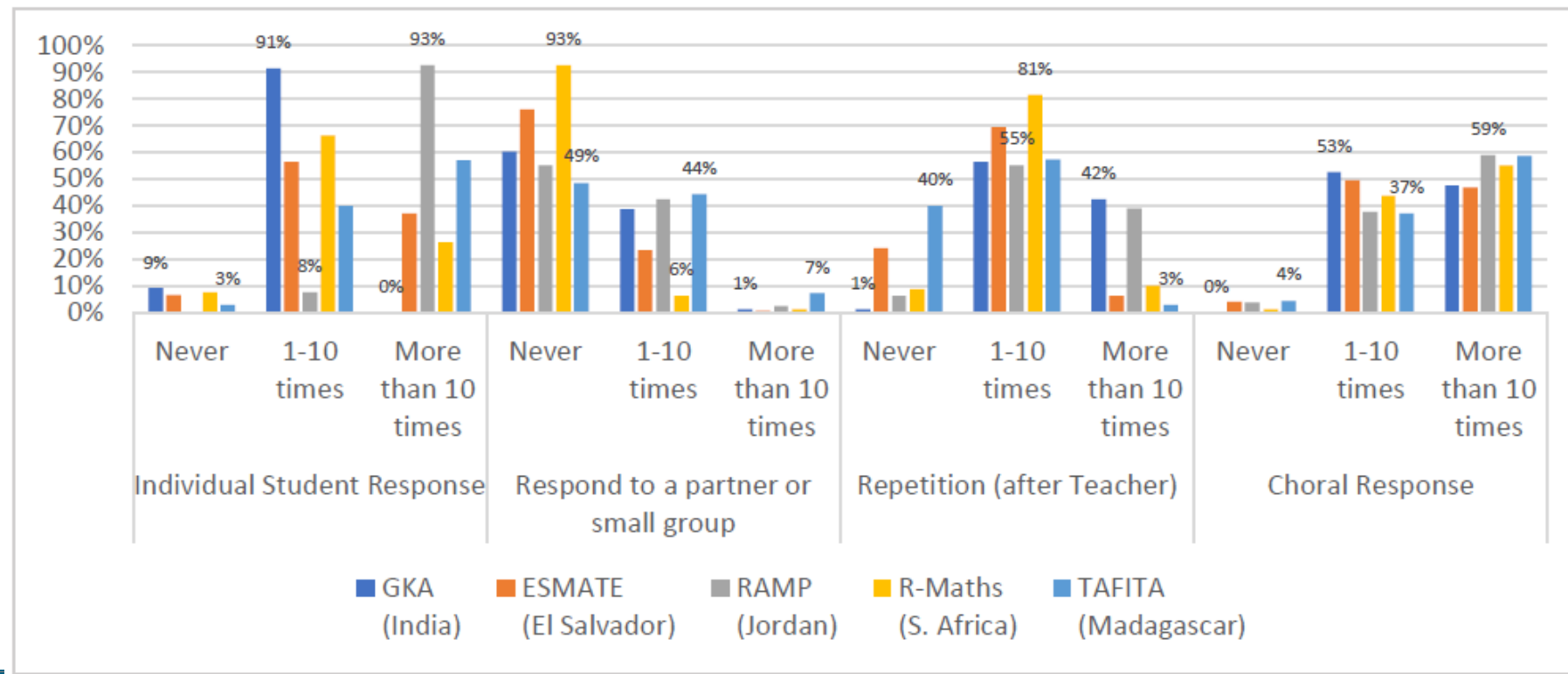
Percent of lessons where teacher connects math concepts to real-life examples or lives of students.

KEY FINDINGS – RQ1: *What teaching practices lead to learning?*

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**



KEY FINDINGS – RQ1: *What teaching practices lead to learning?*

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**

		GKA (India)	ESMATE (El Salvador)	RAMP (Jordan)	R-Maths (South Africa)	TAFITA¹⁰ (Madagascar)
Independent or group work: Students working on their own	Percent of lessons (frequency)	58%	86%	61%	78%	57%
	Average time (duration, in minutes)	10	19	10	18	11
	Average % of total class time	25%	43%	29%	40%	27%

Independent or groupwork, by program

KEY FINDINGS – RQ1: *What teaching practices lead to learning?*

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**



KEY FINDINGS – RQ1: *What teaching practices lead to learning?*

Theme 4: Assessment-informed instruction.

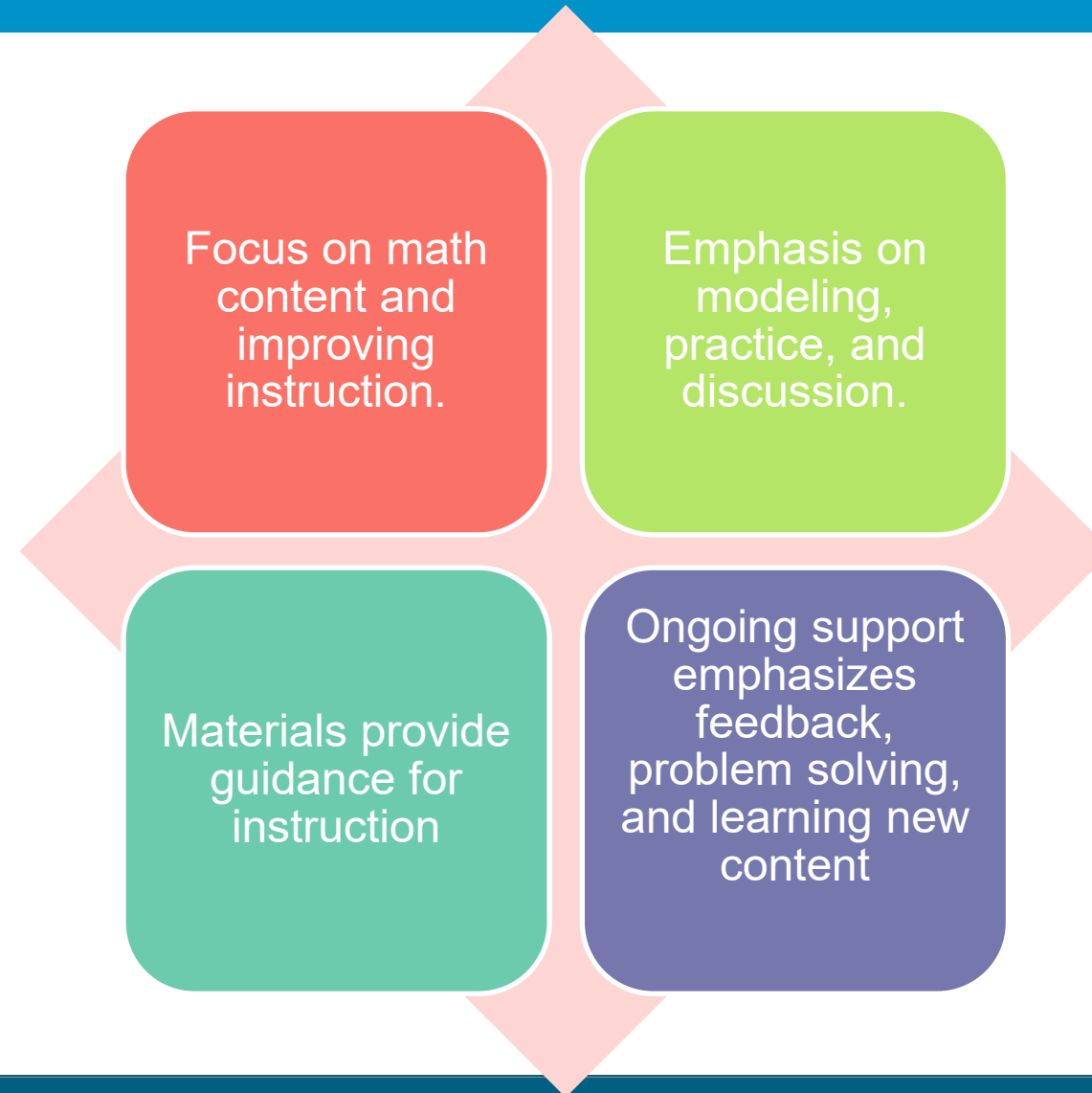
Teacher use formal and informal assessment to inform instruction by:

- **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



IMPLICATIONS FOR TEACHER PROFESSIONAL DEVELOPMENT

RQ2 Key Findings:



IMPLICATIONS FOR TEACHER PROFESSIONAL DEVELOPMENT

- 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.



THANK YOU!

Read more about the Numeracy at Scale study at <https://learningatscale.net/numeracy-findings/>.

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