Instructional Models in Early Mathematics

Can the "I do, We do, You do" model support the development of mathematical thinking?

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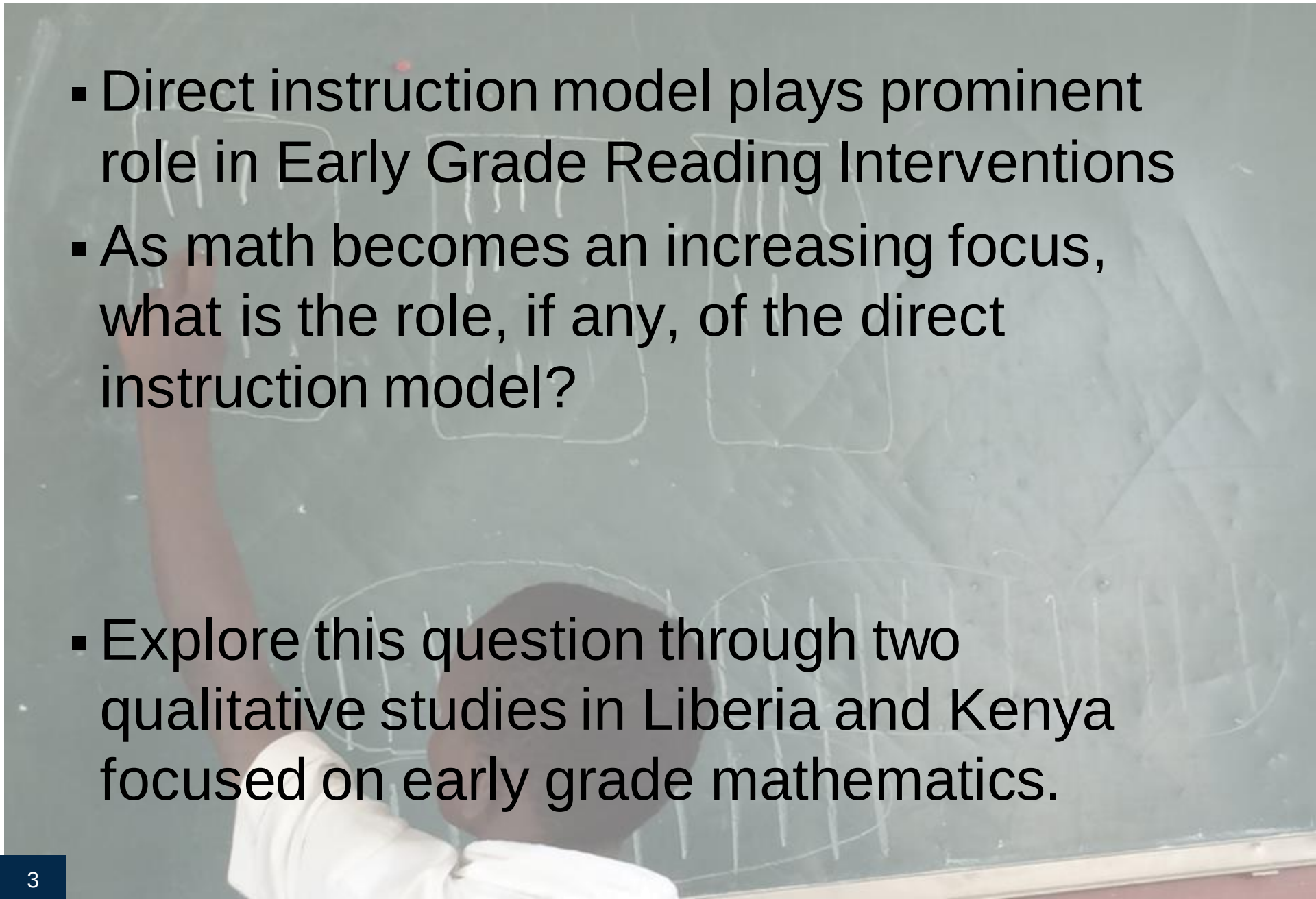
Outline

- Purpose
- Best practices in early mathematics instruction
- Case studies
  - Liberia LTTP2
  - Kenya Tayari
- Conclusions and next steps

Purpose



- Direct instruction model plays prominent role in Early Grade Reading Interventions
- As math becomes an increasing focus, what is the role, if any, of the direct instruction model?

- Explore this question through two qualitative studies in Liberia and Kenya focused on early grade mathematics.

Best Practices in Early Mathematics

- Use of Explanation and Justification
  - Why? How?
- Use of developmental progressions
- Connecting formal and informal mathematics
- Multiple Representations
  - Varied means to represent number

Carbonneau, Marley, &Selig 2013; Carr and Alexeev 2011; Siegler and Lortie-Forgues 2014; Agodini et al. 2010; Ball 1993; Baroody, 2012; Clements & Sarama, 2015; Fennema et al. 1989; Gersten et al. 2009; Lampert & Cobb 2003; Ma 1999; National Research Council, 2001; Nickson 1992; Platas 2014, ; Saxe et al. 2001; Sloan, 1993; Vernaud 1992

Best Practices in Early Mathematics

- Classrooms:
  - Manipulatives in the hands of students
  - Talk and discussion
  - Less teacher-directed time, more active student time

Case Studies- Liberia Teacher Training Project (LTTP2)

Liberia Teacher Training Project (LTTP)

The program consisted of:

- Lesson plans and student books in reading and math for teachers in grades 1-3
- Intensive training of coaches and teachers

Liberia Teacher Training Project (LTTP2): Teacher's Guide

Teacher Activities
"I do."

We have learned how to count up to 15. You have also learned how to write these numerals. Today I will teach you about counting to 20.

Step 1

I will count from 0 to 20 a few times. Practicing my counting helps me remember how to count these numbers in order.

Count from 0 to 20 three times, saying each number clearly and slowly.

Step 2

Draw 15 lines on the board and count them aloud.

I'm going to count these lines: 1-2-3-4-5-6-7-8-9-10-11-12-13-14-15.

Continue to draw 1 line at a time up to 20. Stop after each line and name the number of lines in all. Write the numerals from 16 to 20.

Step 3

Now I will teach you the numerals from 16 to 20.

Write the numerals 16, 17, 18, 19, and 20 on the board. Say each number. Explain that the numeral 16 is a 1 followed by a 6, 17 is a 1 followed by a 7, 18 is a 1 followed by an 8, and 19 is a 1 followed by a 9. Point out that 20 is a 2 followed by a 0.

Teacher and Student Activities
"We do."

Step 4

Everyone, let's practice counting from 0 to 20 and finding the numerals from 16 to 20 together.

Count from 0 to 20 with students, writing in the numerals from 0 to 15 that you didn't write on the board earlier. Then name numbers from 0 to 20 and choose students to come to the board and point to the numerals.

Step 5

Draw 8 circles and 8 rectangles on the board.

How many circles have I drawn? (8) ***How can we show that there are 8 circles?*** (by writing the numeral 8)

Write the numeral 8 below the circles.

How many rectangles have I drawn? (8) ***How can we show that there are 8 rectangles?*** (by writing the numeral 8)

Write the numeral 8 below the rectangles.

Are there more, less, or the same number of rectangles as circles? (the same number) ***same number of circles and rectangles?*** (by adding an equal sign)

Add an equal sign on the board to complete the equation 8 = 8.

Student Activities
"You do."

Step 6

Have students work in pairs. Show 2 groups of objects, with no more than 5 objects total. Ask how many objects there would be if you put the groups together. Have pairs of students decide on an answer together and then choose 1 student pair to tell the answer to the class. Repeat this activity with other groups of objects.

Step 7

Practice Exercise: Have students continue to work in pairs. Have 1 student count from 0 to 20 twice and the other student listen to make sure the first student is counting correctly. Then have students switch jobs. After this, have students take turns writing numerals and having their partners name them.

Step 8

Application: (page 27) Ask students to complete the page in class. Move around the classroom and review their work as they complete the exercises.

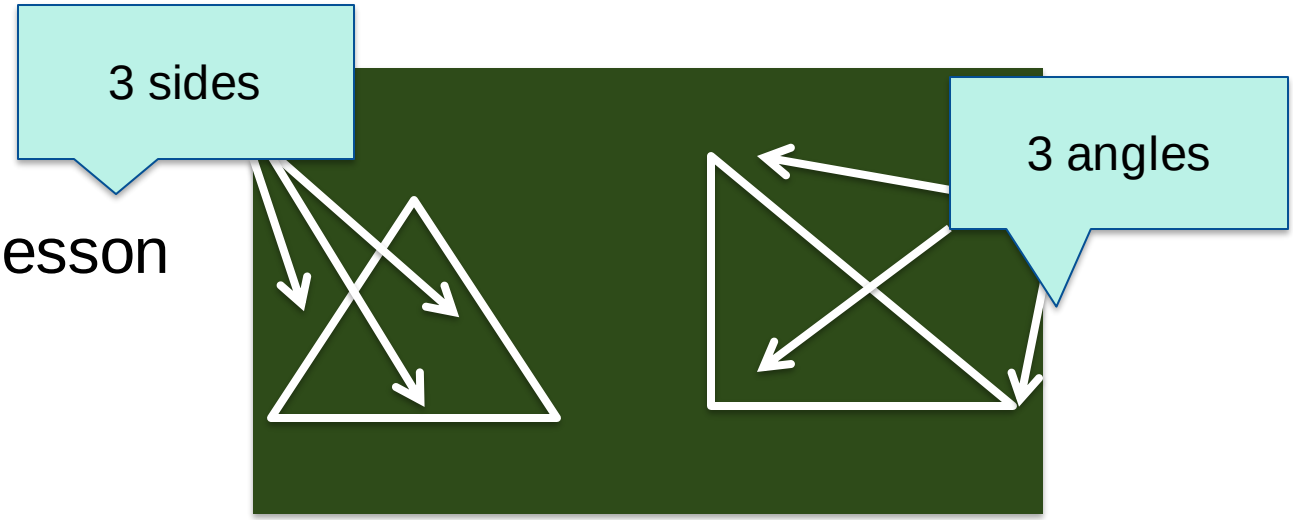
Liberia Teacher Training Project (LTTP2): Methods

- 15 teachers in 3 counties were observed teaching a math lesson
- Observations focused on pacing, use of materials, and modifications to the lessons
  - All lessons were from the Grade 1 teacher's guide

Liberia Teacher Training Project: Student Participation

Teacher either lowers or increases the amount of participation, or alters the nature of participation

What the lesson said:



What the Teacher did:

Class, how many sides and angles do the triangles have? How do you know?

Liberia Teacher Training Project (LTTP2): Student Participation

Teacher either lowers or increases the amount of participation, or alters the nature of participation

What the lesson said:

Class, can you tell me different ways to make 20 by adding 2 or 3 numbers?

What the Teacher did:

10 + 10 = 20
15 + 5 = 20
12 + 8= 20
14 + 6 = 20

Here are ways to make 20 by adding 2 or 3 numbers.

Case Studies- Kenya Tayari Project

Tayari

1. Support the National Government to develop a ***tested, cost-effective, affordable and scalable*** early childhood model.

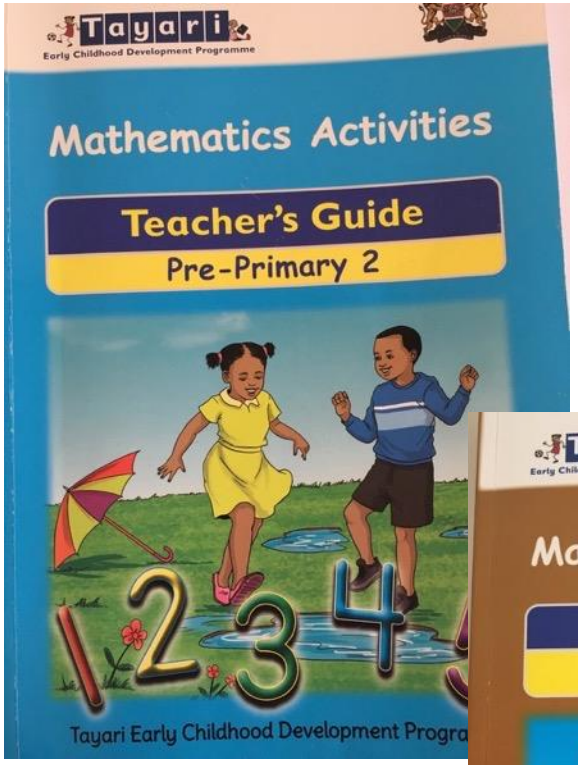
2. Support the County Governments to provide ***quality early childhood education*** across four selected counties, and scale-up beyond

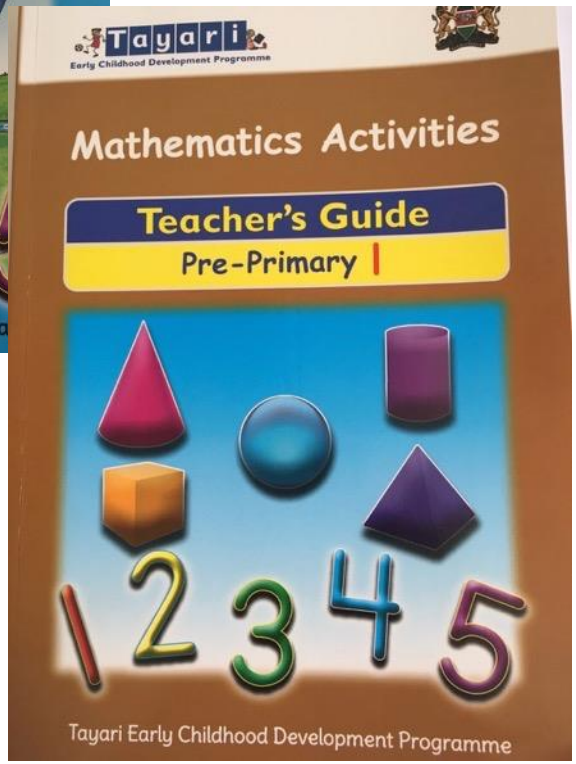
3. To enable ***global uptake*** based on Kenya's experience.

Tayari
Early Childhood Development Programme

Tayari: Materials

- Pre-primary 1 (4-5 year olds) and Pre-primary 2 (5-6 year olds)
- Teacher's guide with daily activities, student book.





Tayari: Materials

Introduction

- Sing a number song.
- Rote count 1–10 with actions e.g. clapping, jumping, nodding.

Main Activity

Matching and drawing

Whole class

Demonstrate the following activity:

- Put 6 objects/counters and a set of number cards 1 to 6, face down on the desk. Make sure the cards are not in order.
- Pick up a number card and ask the learners to say the number.
- Guide them to count the same number of objects as the number on the number card.
- Draw an equivalent number of objects on the board while counting aloud as you draw. Write the number on the board. Emphasize to the learners how to form the number correctly. Tell them to practise writing the number in the air.
- Repeat the steps with other numbers.

Small group

- Give groups of learners 6 objects and a set of 6 cards with numbers 1–6 placed facing down.
- Guide them to pick one card at a time and count the corresponding number of objects. Guide learners to write the number and draw an equivalent number of objects in their work books.

Conclusion

- Play a game with learners where you write 3 numbers on the board (2, 4, 6). Touch a number and ask the learners to show you the an equivalent number of fingers.

Workshop Model: whole class, small group

Tayari: Methods

- 7 teachers in Uasin Gishu county were observed teaching a math lesson
  - 3 teachers taught Pre-primary 1 (ages 4-5)
  - 4 teachers taught Pre-primary 2 (ages 5-6)
- Observations focused on three core areas
  - instructional practices
  - use of resources
  - small-group or independent work

Tayari
Early Childhood Development Programme

Tayari: Results in Small Group Work

- 6 out of 7 lessons had small group work time, and in 4 of these lessons, children worked independently
- Teacher 04 modeled activity picking a number card, counting out the same number of objects, and then drawing the objects in the workbook.
- Children did same activity at their own pace, teacher walked around the room

Tayari: Results in Small Group Work

- Teacher 02 modeled activity where the number card “7” was picked, and then students counted out 7 objects.
- In small group time, the teacher gave each group 7 objects. She went to each group and asked each child in the group to count the 7 objects out loud.
- The other students in the class watched as the student counted, but did not use the materials unless the teacher was in front of them.

Conclusions

Conclusions

- Classrooms:
  - Manipulatives in the hands of students
  - Talk and discussion
  - Less teacher-directed time, more active student time
- Liberia
  - More teacher talk, and tendency to make “we do” and “you do” into I do
  - Less student participation
- Kenya Tayari
  - More small group work, both directed and independent
  - More student participation

Conclusions

- The workshop model fostered classrooms that resembled something closer to what we would expect according to best practices
  - Workshop model is similar to a “we do, you do” model

- The direct instruction model tended to lower student participation and centered on teacher talk
  - It may be that removal of the “I do” section encourages teachers to involve students more in instruction

Conclusions

- Role for I do for some skills?
  - Driving a manual car
  - Learning quantity

- More research should be done, at larger scale, to test and evaluate different instructional models for mathematics