

# SCIENCE OF TEACHING

MATH EDUCATION WEBINAR #2:

## STRENGTHENING TEACHER CONTENT AND PEDAGOGICAL CONTENT KNOWLEDGE

Tuesday, 11 June 2024

# SCIENCE OF TEACHING

MATH EDUCATION WEBINAR #2:

## STRENGTHENING TEACHER CONTENT AND PEDAGOGICAL CONTENT KNOWLEDGE

Tuesday, 11 June 2024



WELCOME!



# Agenda

- ▶ MEET THE PRESENTERS
- ▶ PURPOSE: Webinar Series & CoP
- ▶ PRESENTATIONS
- ▶ PANEL
- ▶ Q&A
- ▶ BREAKOUT GROUPS
- ▶ REGROUP & REPORT OUTS
- ▶ CLOSING REMARKS

# Meet the Presenters

Moderator:

## Wendi Ralaingita

- ▶ Dr. Ralaingita is a Senior Education Advisor at RTI International and the Principal Investigator of the Gates Science of Teaching Grant. Dr. Ralaingita designs and supports RTI programs focused on improving teaching and learning in primary-level mathematics and reading.



# Mercy kazima

- ▶ Dr. Kazima is a Professor of Mathematics Education at the University of Malawi. She has substantial experience in teaching and researching mathematics education in Malawi and the southern Africa region.



# Lynn Bowie

- ▶ Dr. Bowie is director of Mathematics at OLICO Maths Education and a Visiting Associate at the University of Witwatersrand. She has developed material and designed programs to support mathematics learning at all levels from early grades through to university level.



# Norma Evans

- ▶ Norma Evans is a former mathematics teacher, curriculum coordinator, and faculty member at Simon Fraser University (Canada), where she developed and delivered undergraduate and graduate mathematics methods courses for preservice and in-service teachers.



# PURPOSE:

## Webinar

### Series & CoP

- ▶ Promote resource sharing, networking and discussion
- ▶ Foster opportunities for collaboration
- ▶ Share research evidence
- ▶ Give members a voice in future webinars and CoP activities
- ▶ Garner sustainability and growth of the community beyond the end of SoT



# PRESENTATION #1

DR. MERCY KAZIMA, *UNIVERSITY OF MALAWI*

# Developing teachers' mathematical knowledge for teaching: an example of project from Malawi

Mercy Kazima  
University of Malawi



# Developing teachers' mathematical knowledge for teaching: an example of project from Malawi

- Part of project called: *Strengthening Numeracy in early years of primary school*
- Focused on Grades 1 and 2 teachers
- Worked with 11 schools and 136 teachers (2019-2022)
- Offered professional development using lesson study model
- Process: Workshop 1 (May), Lesson study in schools (May-Nov) Workshop 2 (November)



# May-Nov: Lesson study in schools

- Aim to learn from own teaching and students' learning
- Teachers at each school work together as a group
- Teachers draft lesson plan
- Project team review drafts
- Feedback and discussion



██████████, standard 1B

Dear teachers

First of all, thank you for all the work you have done with the plan we have received. We enjoyed reading it. We have made some comments or asked some questions before revising the lesson plan and conducting the research lesson in your classroom. We would like you to fill in some more details:

- We know that there are many learners in your classrooms. How many learners are there in the classroom of standard 1B?
- How many teachers are you working together with this lesson plan?  
Estimated time to be spent on the different activities/steps of the lesson plan:

Some more comments and questions to help you develop the lesson plan follow:

Aim of the lesson/research questions:

Understanding how learners identify patterns is an interesting research question. It is easy to understand the connection between this research question and the curriculum statement "Learners must be able to count numbers up to 50". What do you mean by patterns? Do

# May-Nov: Lesson study in schools

- Teachers revise lesson plan
- One teacher teaches while others observe
- Reflection on lesson
- Reporting and discussion

RESEARCH LESSON PLAN			
Standard	2	Date:	
Learning area	Mathematics	Time:	
Core Element	Number, Operations Unit 1: Counting and Relationships	up to 99	
Number of learners	60	Age range:	7-12
Ability	Mixed	Number of teachers working together	5
RESEARCH QUESTIONS			
1. What different ways do learners count to 99.			
2. What different ways do learners count objects when counting			
Success Criteria			
Learners must be able to:			
. Count up to 99			
. fill in missing numbers			
Teaching, learning and assessment resource			
bottle tops, sticks, plastic tumblers and number cards			
Teacher activities	Learner activities	Prediction of learner strategies	Observation
Introduction (2 minutes)	Sing a song	Counting numbers using fingers	non-verbal class
Sing a song related to counting e.g. Triceratops march with learners		Counting numbers using fingers	non-verbal class
Developmental Steps			



# Development of teachers' mathematical knowledge for teaching (teachers' reflections)

- Analysis of teachers' journal reflections before and after the Professional Development
- Teachers understanding of teaching number and counting improved
- Teachers' views about teaching and learning changed from transmission and acquisition to transformation and participation



- I have differentiated ways how we can teach collections or I have an idea of how I can teach counting collections using different ways.

iii We also as teachers, developed each work spirit we observed more from the learners because everyone had a chance to observe ~~learn~~ learners performances.

Thank you very much!

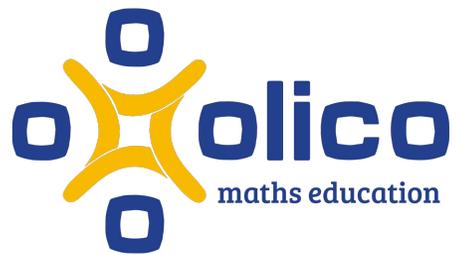




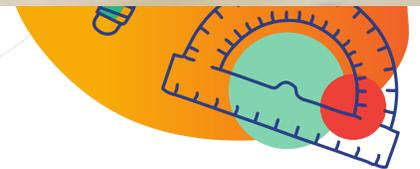
# PRESENTATION #2

DR. LYNN BOWIE, *OLICO*

# Supporting teachers with a WhatsApp API course



[www.olico.org](http://www.olico.org)



MATHS GLUBS OLICO Maths Clubs +27600480000

Time required: 30mins.

Start Lesson

Main Menu

Start Lesson

Start by watching Video 1 of 3:

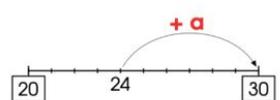
MATHS GLUBS PEP4 Module 4 week 1  
Lev 13 Module 4 week 1  
Adding two digit numbers

Video 1: Adding two-digit numbers pt 1.

Click After Watching

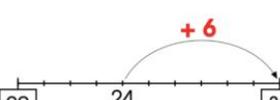
MATHS GLUBS OLICO Maths Clubs +27600480000

Question 4 of 5

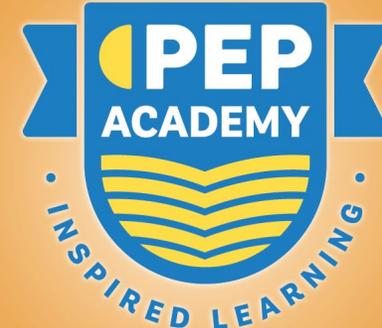

  
 $a = \underline{\quad}$

$a = \underline{\quad}$   
 Send **P** to exit this lesson.

5



# PEP 4 Maths Teacher's book



olico math education

SA NUMERACY CHAIR

fat

# Lesson 1: Less is more



Two different  
tech delivery  
mechanisms  
at one time

Watch video – closely  
linked to lesson

Do questions to check  
understanding

Change  
management  
– culture of  
preparation

Create brief video to  
practice explanation



# Lesson 2: Key messages need revisiting

## 3 C's



Move on from count  
to calculate  
and comfort with numbers



cold call



clap clap show



think pair share



circulate and observe

CFU

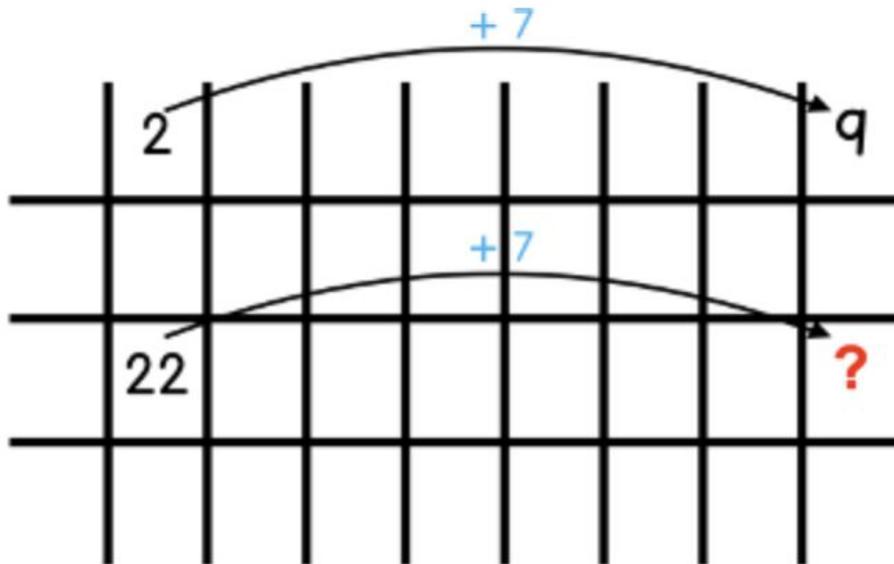
connect

old to new

parts of the class

representations to concepts

# “Lesson” 2: Key messages need revisiting



If we ask learners to figure out what number goes in place of ?, we would like them to:

A: Count on 7 from 22 i.e. 23, 24, 25, 26, 27, 28, 29

B: Use the fact that they know  $2 + 7 = 9$  to say  $22 + 7 = 29$

C: Both of these methods are equally good.

Almost 50% of respondents chose A or C

# Pre-test

**Question 6:**

Your class is given the question:

$$\underline{\hspace{2cm}} - 23 = 14$$

A learner tells you they do not know how to figure out what number goes in the gap. How would you help them to solve the problem?

n	23 + 14 = 37	Answered 9	Use inverse	PPW/NL explanation	Left out	Wrong explanation
54	31	5	8	1	6	8

I would tell them to add

Orientation to maths:  
Explain = tell what to do  
not explain why

$$23 - 14 = 9$$

CCK

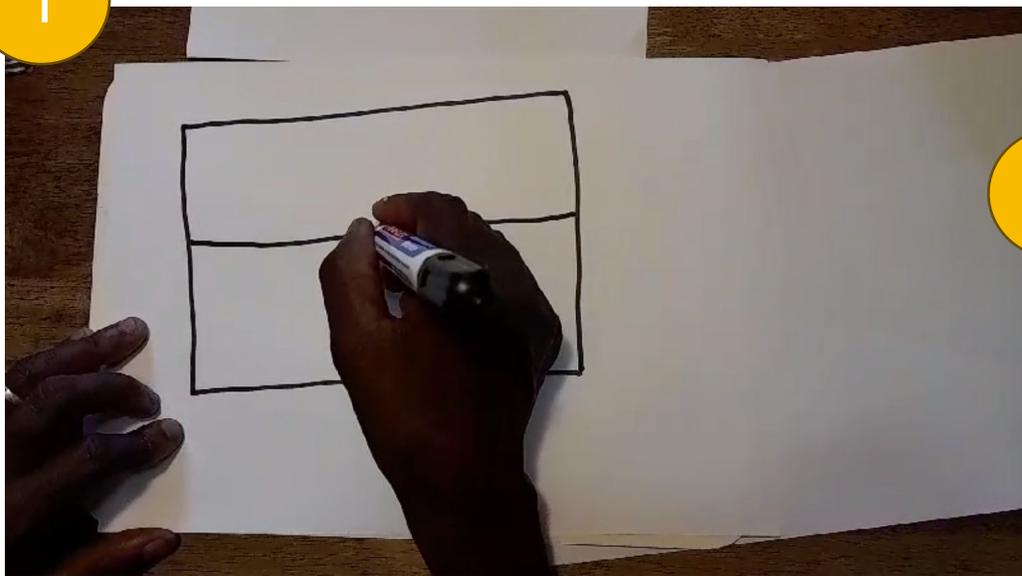
We use the inverse operation (opposite signs) and add the numbers

KCT

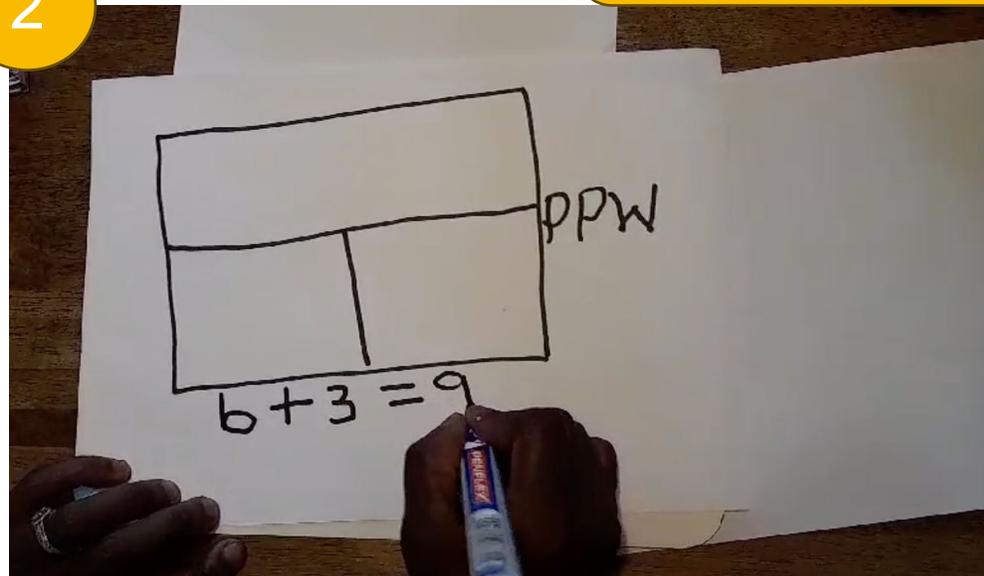
Just ask learners to stand in front of the class and count how many learners are there altogether then 23 must go back to their seats. How many learners have left?  $37 - 23 = 14$

"Curse of knowledge"

1

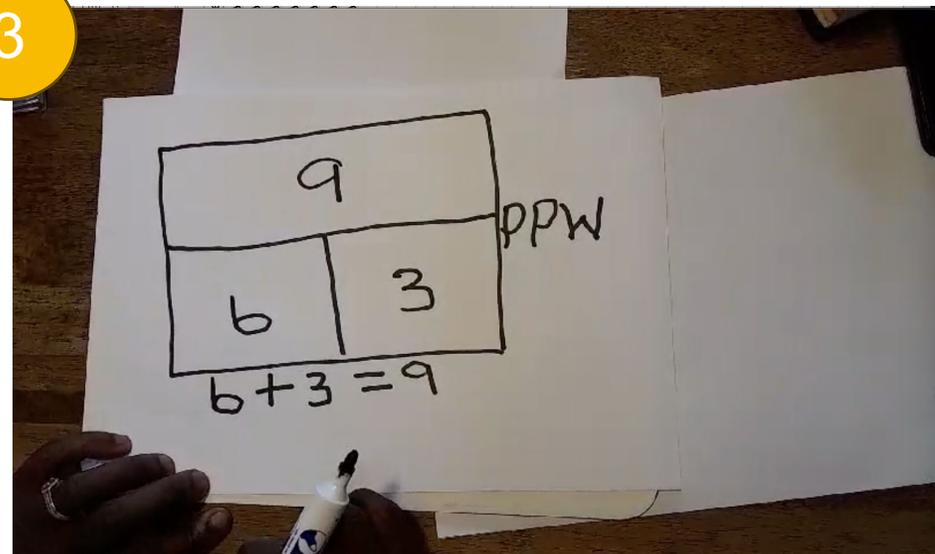


2

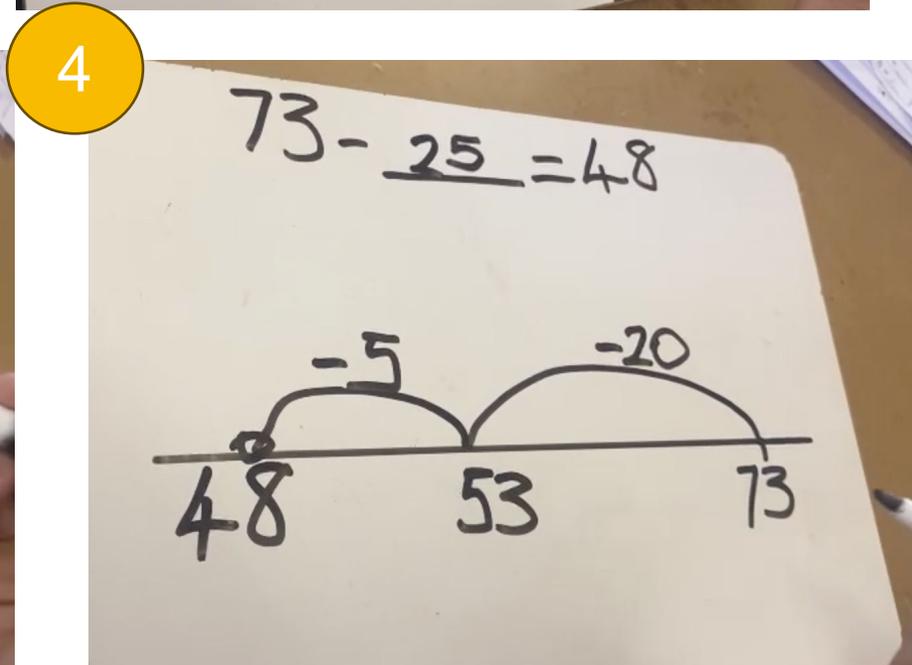
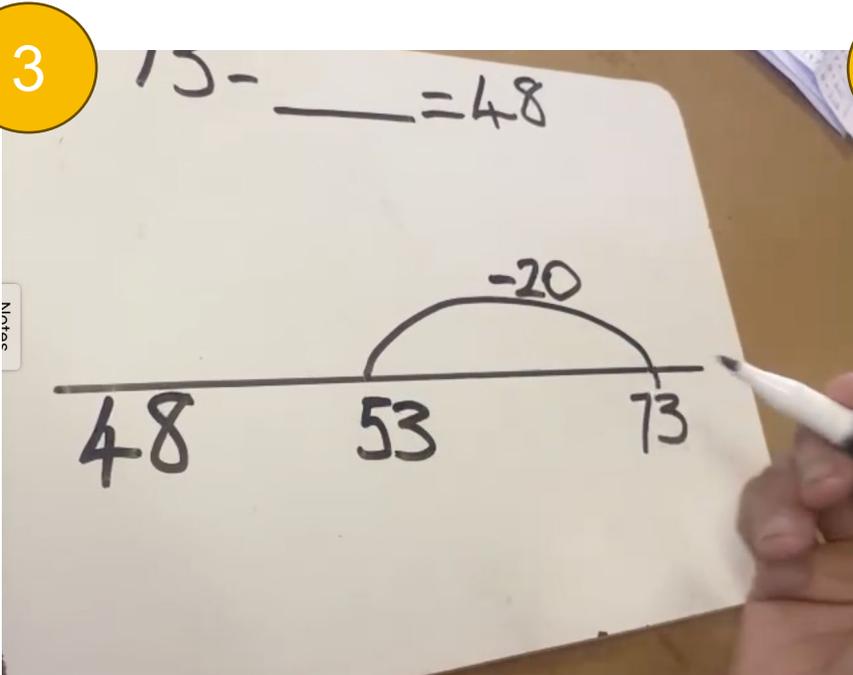
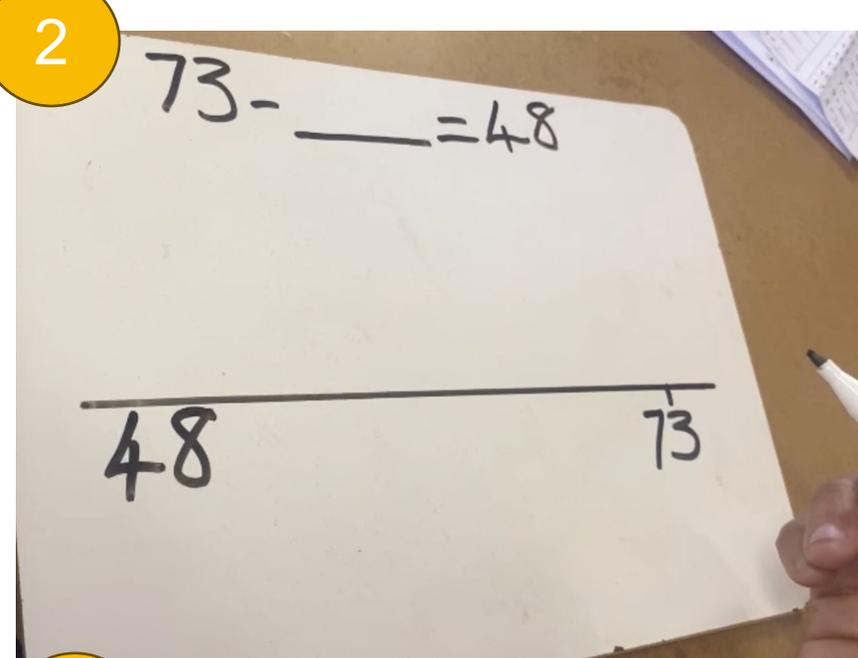
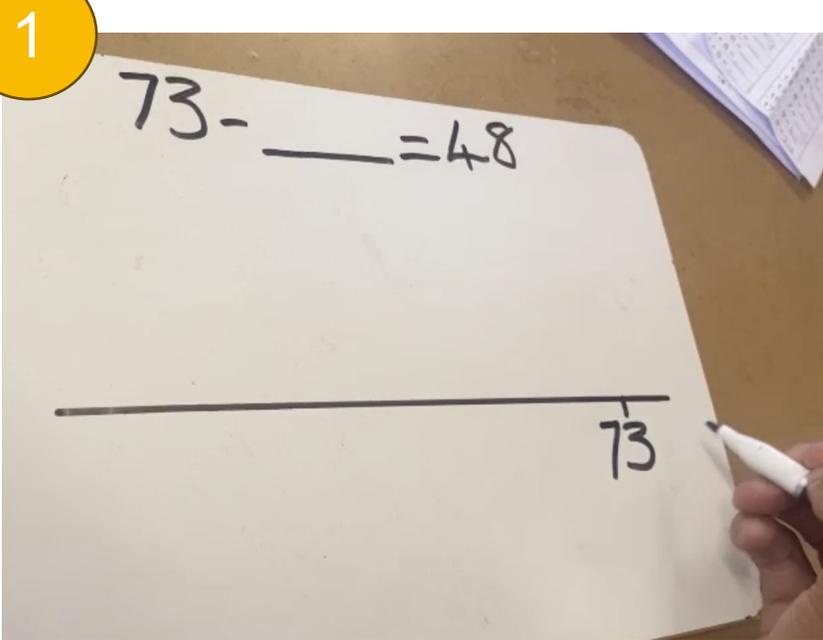


# Video mod 1

3



$$9 - \underline{\quad} = 6.$$



# Video mod 3

$$\begin{array}{r} 73 - \underline{\quad} = \\ 48 \\ . \end{array}$$

**THANK YOU!**



# PRESENTATION #3

NORMA EVANS, EVANS AND ASSOCIATES

Building teachers' content and  
pedagogical  
content knowledge  
through authentic problem-solving

Ghana, STS International

Norma Evans

*Evans and Associates Educational Consulting*

# Our hypothesis

---

## **SCHOENFELD'S THEORY OF TEACHING**

**(1998, 1999, 2009)**

Teachers' instructional models and associated classroom practices are determined by their knowledge and beliefs about learning, which are themselves rooted in their personal experiences as learners



## **SHIFTING TEACHERS' BELIEFS' AND BY IMPLICATION THEIR CLASSROOM PRACTICES (SCHOENFELD, BALL & Cohen 1999)**

Have teachers experience first-hand (or through video analysis) math learning experiences, then deconstruct and reflect on:

what was learned,

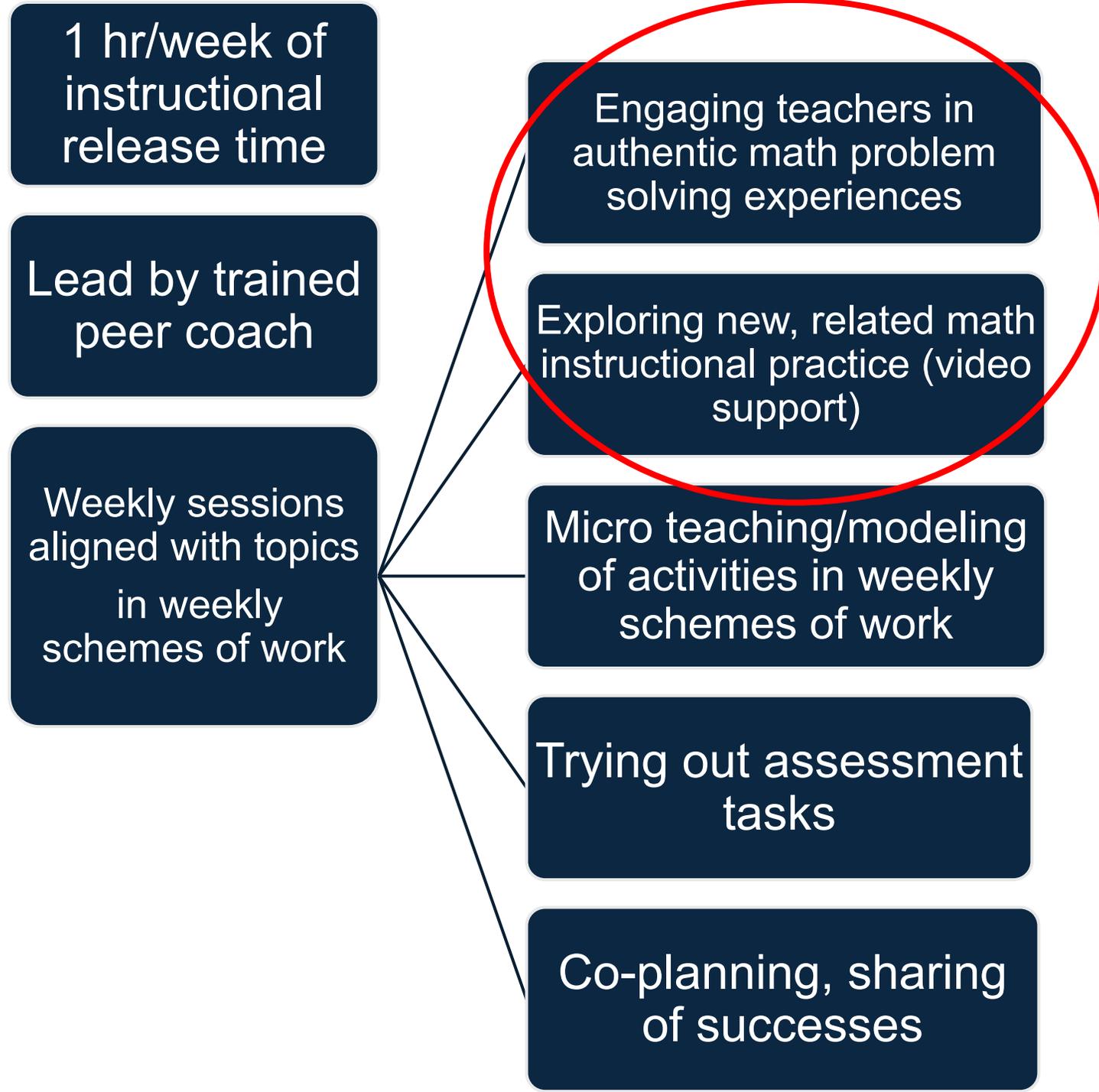
how it was learned, and

what that says about mathematics as a discipline, as well as about the teaching-learning process

## What we did to support our hypothesis...

School-based in-service model with a volunteer teacher from the school trained to lead the sessions

Mentor guide that laid out the activities to undertake each week.



# Place value

I am thinking of a two-digit number. The digits add up to 7.

- What could the number be?
- What is the largest number the number could be? How do you know?
- What is the smallest number the number could be? How do you know?
- What is the largest number the number could be if none of the digits is a zero? How do you know?

Kobby is given 23 counters.

His teacher asks him to show how many counters represent the 3 in 23.

Kobby holds up 3 counters.

Then his teacher asks him to show how many counters represent the 2 in 23. Kobby holds up 2 counters.

Is he correct? Why or why not?

# What happened...

- Teachers' self-confidence, enjoyment of mathematics, and enjoyment of teaching mathematics, improved greatly (*anonymous survey*).
- Teachers identified working through math problems and hearing how others solved them as the second most important professional development activity (out of 10) that contributed to their learning how to teach mathematics (*anonymous, rank-order survey*).
- After 1 year, used significantly more inquiry or reasoning-based mathematics instructional strategies (*classroom observations, RCT*)

# Pupils' math scores improved significantly (RCT)

Gr 1

		Coefficient		
		Overall	Female	Male
EGMA	Number Identification (correct per minute)	0.580	0.474	0.702**
	Addition (correct per minute)	1.401***	1.433***	1.252***
	Subtraction (correct per minute)	0.850***	0.810**	0.721**
	Quantity discrimination (% correct)	4.930***	2.855	6.198***
	Missing number (% correct)	5.531***	4.308***	6.453***
	Word problems (% correct)	5.671***	5.135***	5.675***
GENA	Place value bundles	23.20***	20.16***	25.78***
	Number deconstruction	16.60***	12.30*	19.65***
	Describing numbers	17.35***	15.77***	17.43***
	Number operations A	13.00***	16.07***	11.36**
	Number operations B	8.661**	8.777*	7.550*

Thank you!



PANEL

# Q&A

# BREAKOUT GROUPS

30 MINS

**GROUP #1:** WHAT IS MEANT BY MKT, PEDAGOGICAL CONTENT KNOWLEDGE, OR SIMILAR FRAMES? HOW DO THESE DIFFERENT FRAMES DEFINE WHAT TEACHERS NEED TO KNOW TO BE 'GOOD' TEACHERS?

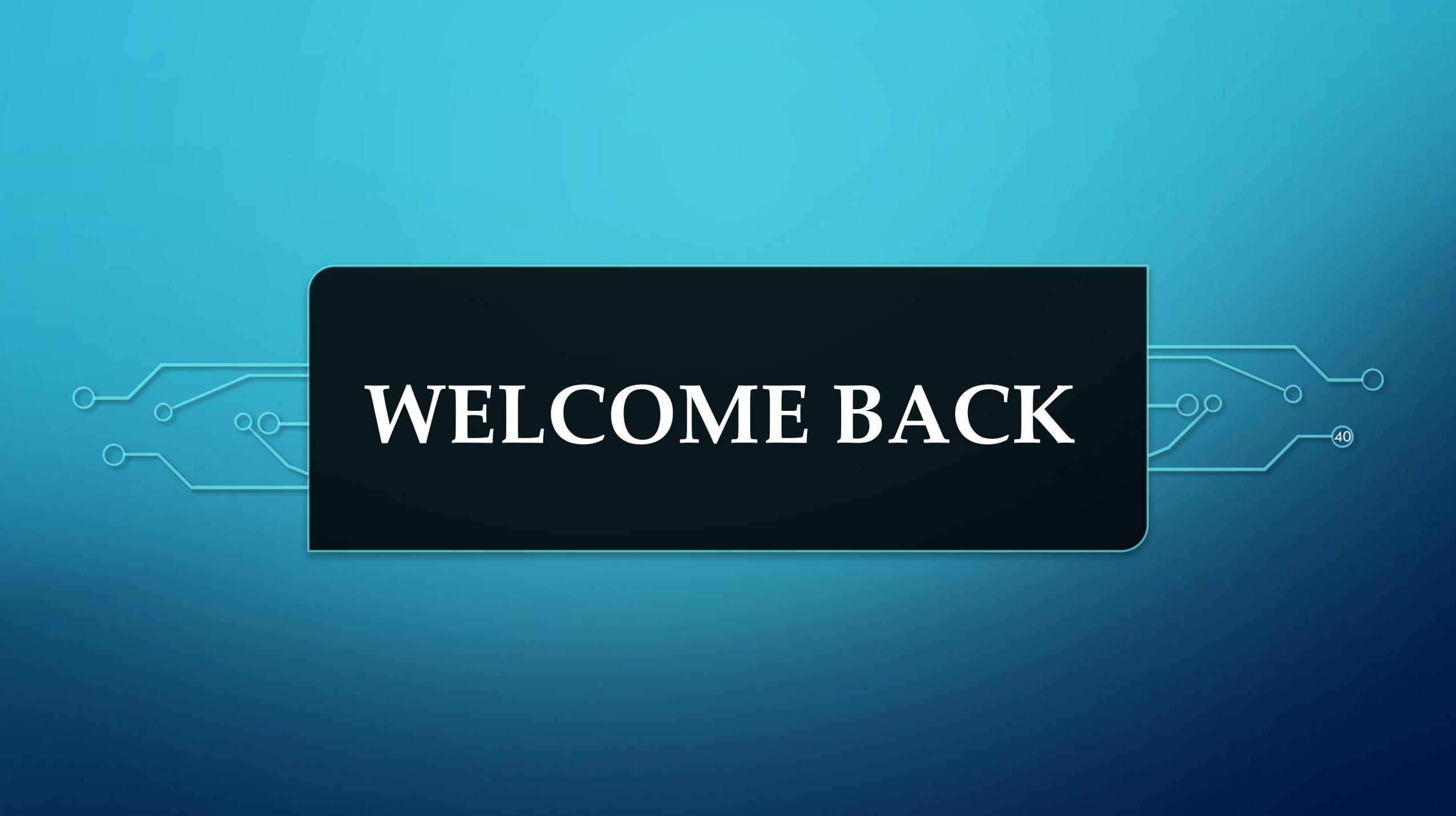
**GROUP #2 :** WHAT ARE OTHER APPROACHES THAT PARTICIPANTS HAVE TRIED TO DEVELOP TEACHERS' CONTENT AND PEDAGOGICAL CONTENT KNOWLEDGE AND OTHER FRAMES? WHAT HAS WORKED AND WHAT HAS NOT WORKED?

**GROUP #3:** SHOULD THE MEASURE OF TEACHER PD AND INTERVENTIONS TO IMPROVE TEACHER KNOWLEDGE/VIEWS BE STUDENT LEARNING OUTCOMES? IF NOT, WHAT ARE OTHER WAYS TO UNDERSTAND AND SHARE IMPACT ON TEACHERS?



# BREAKOUT GROUPS

30 MINS



**WELCOME BACK**



**GROUP #1: WHAT IS MEANT BY MKT, PEDAGOGICAL CONTENT KNOWLEDGE, OR SIMILAR FRAMES? HOW DO THESE DIFFERENT FRAMES DEFINE WHAT TEACHERS NEED TO KNOW TO BE 'GOOD' TEACHERS?**



**GROUP #2 : WHAT ARE OTHER APPROACHES THAT PARTICIPANTS HAVE TRIED TO DEVELOP TEACHERS CONTENT AND PEDAGOGICAL CONTENT KNOWLEDGE? WHAT HAS WORKED AND WHAT HAS NOT WORKED?"**



**GROUP #3: “SHOULD THE MEASURE OF TEACHER PD AND INTERVENTIONS TO IMPROVE TEACHER KNOWLEDGE/VIEWS BE STUDENT LEARNING OUTCOMES? IF NOT, WHAT ARE OTHER WAYS TO UNDERSTAND AND SHARE IMPACT ON TEACHERS?”**



# CLOSING REMARKS

**Scan the below code to  
provide feedback!**

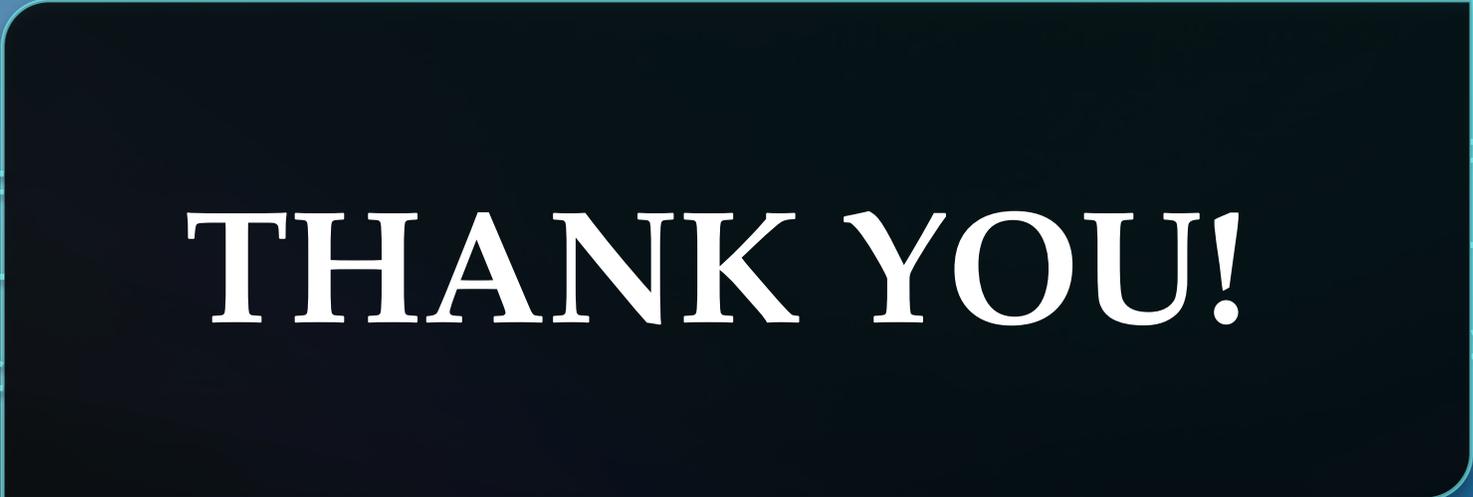


**Scan me!**

**Scan the below code to join  
the Math CoP!**



**Scan me!**



**THANK YOU!**