

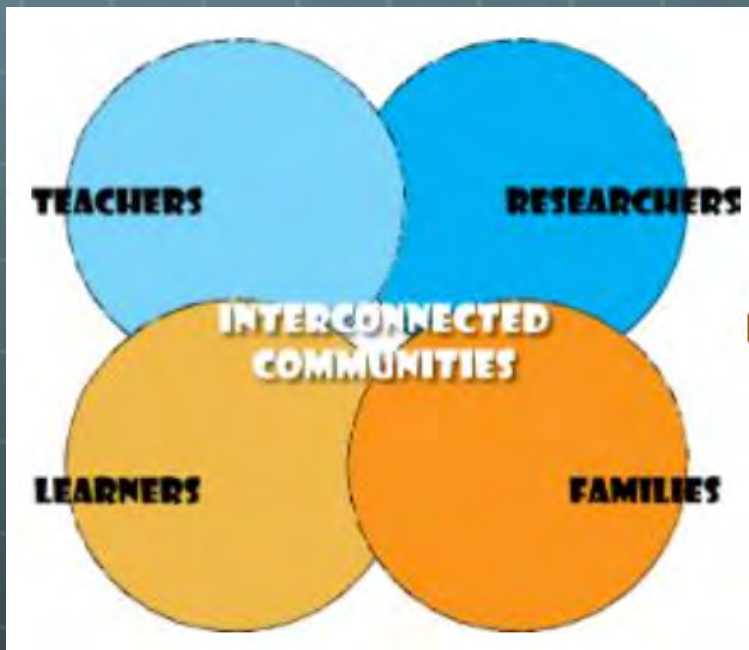
Adapting number talks to foreground mathematical progression in South African classrooms

Debbie Stott and Mellony Graven

South African Numeracy Chair Project
Rhodes University, South Africa

Developing mathematical language and reasoning - International Symposium Elementary Maths Teaching
Prague - August 2015

Our context



- End of 5 year development and research project
- Focus on grades 3 & 4
 - 12 schools (\pm 45 teachers)
 - Collect data from \pm 1200 learners per year
- Aim to develop mathematical proficiency in all our learners

1. After school maths clubs

- ### 3. Post-grad research supervision

South Africa

Relative wealth in the African region
comparatively high expenditure on education

We are still at the bottom of the performance tables

The problem

Many contributing factors but 2 for this paper

Language: switch from mother tongue instruction

Classroom practice: teacher talk/ learner chorsing

Procedural and low cognitive demand

Key on-going focus



To develop

increasingly active
learner participation

exploratory talk

sense-making

mathematical
progression



enabled through strategic use of
teacher and peer mediation

Number talks: an intervention strategy – An international perspective

- 🌐 for simultaneously developing **number sense** and **mathematics facts**
- 🌐 “short teaching activities that teachers can use as lesson starters”
 - 🌐 Learners solve a given problem mentally
 - 🌐 Share different methods
 - 🌐 Discuss why they work

Initial concerns

- 🌐 having watched the USA number talk videos we noted that:
 - 🌐 the learners were used to talking about their mathematical thinking
 - 🌐 the class / group sizes were small
 - 🌐 the classrooms were well resourced
 - 🌐 the teachers had a rich repertoire of mediatory prompts

Would they work in our classrooms?

Given the key language and pedagogical challenges identified above as well as the issue of overcrowded classrooms, we were aware that our number talks were unlikely to unfold in the same way as the USA number talks we had watched

Methodological approach

- Design research
 - Pilot with 1 teacher in 1 of our schools
 - Class of Grade 4 isiXhosa speaking learners
 - Piloted 3 number talks with this class
 - Noted what worked well & the challenges

Challenges in the classroom

- 🌐 learners writing their methods on the board was time consuming
- 🌐 Large class organisational issues such as access to the board
- 🌐 So
 - 🌐 Learners asked to point or use other gestures to explain their thinking
 - 🌐 Discuss and share methods in smaller groups 1st before opening up whole class discussion

Challenges for teacher practice

- What to say (how to mediate)
- What mediatory prompts to use
- Finding rich problems for the talks
- So
- Developed 2 key teacher resources
 - Key ideas and scaffolds for the talks
 - Selection of carefully selected stimulus problems

Timing	Section of talk	Comments and instructions
30 SECONDS	Hand out cards to groups of learners	
30 SECONDS	Breathe and visualise	Close eyes and visualise the pattern / sum on the card
30 SECONDS	How many and how do you see them? OR Can you solve this problem? Think about how you will explain how you got your answer	No touching No writing
8 MINUTES	Whole class talk	Use the pro Use question Teacher rec Keep all rec listening to Encourage
1 MINUTE	Discussion of strategies	Discuss the Which are r As a class a strategies Write final
30 SECONDS	Recap of efficient strategies	Whole class

APPROX 11 MINUTES

QUESTION PROMPTS

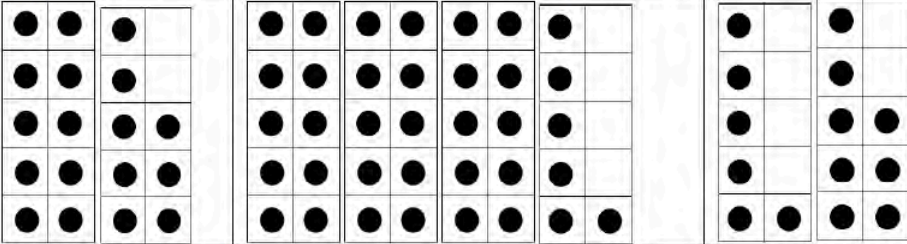
- How did you work that out?
- What was the first thing your eyes saw?
- How did you get your answer?
- How did you solve this problem?
- Who would like to share their thinking?
- Who did it another way?
- How many people solved it the same way as Mpho?
- Does anyone have the same answer but a different way to explain it?
- Can you describe your method to us all? Can you explain why it works?
- What do you think about what Mpho said?
- Do you agree? Why or why not?
- Do you understand what Mpho is saying?
- Can you convince the rest of us that your answer makes sense?
- What have you learned or found out today?
- Which strategy seems to be the fastest?

POST TALK ACTIVITIES

- Create and post a class strategy chart after each talk.
- Give quick problems similar to the ones in the week's strategy talks. Learners are required to solve each problem in 2 ways.
- Solve a 'homework problem': Give one example related to the strategy talk. Learners solve the problem using an efficient strategy recapped in a class strategy talk and then use any strategy they wish.

POST TALK REFLECTION

- Which key strategies emerged from the talk?
- What were the successes and challenges of the talk?
- How would you change the prompts or extend the problem for future talks?
- What type of questions did you ask during the talk and how did your learners react to these? Which questions worked best?
- Were there any learners who were not able to see and use the key strategies? What might be done for them?

TYPE OF TALK	10 frames A strong sense of "ten" is key for place-value understanding and mental calculations. 10-frames are useful tools for developing number sense. The ten-frame prompts students to form mental images of the numbers represented.	<ul style="list-style-type: none"> Do not suggest procedures All learners should participate Promote confidence in talking about maths Develop maths vocabulary Allow multiple solution strategies
OBJECT OF LEARNING	<ul style="list-style-type: none"> Learners explain their thinking: HOW they SEE it and WHY it makes SENSE Learners develop increasingly flexible and efficient strategies 	Learners begin to: <ul style="list-style-type: none"> See and use numbers flexibly Reason abstractly 3. Speak mathematically
PROMPT		
QUESTIONS	How many do you see? Can you convince me? Can you give at least 2 different ways of checking how many there are? Which is the quickest for you? Why? Which allows you to be more accurate? Why?	

TYPE OF TALK	Addition and subtraction strategies In this talk, we focus on developing addition and subtraction strategies (see separate chart for description of these strategies). The prompts are carefully selected to elicit certain strategies.				<ul style="list-style-type: none">Do not suggest proceduresAll learners should participatePromote confidence in talking about mathsDevelop maths vocabularyAllow multiple solution strategies
OBJECT OF LEARNING	<ul style="list-style-type: none">Learners explain their thinking: HOW they SEE it and WHY it makes SENSELearners develop increasingly flexible and efficient strategies			Learners begin to: <ul style="list-style-type: none">See and use numbers flexiblyReason abstractlySpeak mathematically	
PROMPT ADDITION	MAKING TENS 7 + 5 7 + 13 7 + 25 9 + 1 + 4 2+6+8+3+4 5+3+5+4+7	DOUBLES/NEAR DOUBLES 15 + 16 17 + 15 49 + 49 48 + 49 99 + 97 398 + 398	BREAKING INTO PLACE VALUE 36 + 22 12 + 37 13 + 14 24 + 32	LANDMARK NUMBERS 48 + 6 48 + 17 23 + 48 48 + 47 28 + 5 + 27 24 + 3 + 48	COMPENSATION 19 + 6 9 + 16 9 + 26 29 + 6 28 + 29 23 + 19
PROMPT SUBTRACTION	ADDING UP 90 - 79 90 - 74 90 - 49 90 - 44 125 - 75 125 - 83	EASIER PROBLEM 49 - 28 59 - 28 99 - 69 101 - 68	REMOVAL 35 - 10 35 - 13 35 - 20 35 - 22 23 - 14 23 - 18 23 - 15	CONSTANT DIFFERENCE 20 - 15 19 - 14 21 - 16 41 - 16 151 - 126 171 - 136	
QUESTIONS	What is your answer and HOW did you work it out?				
ANTICIPATED RESPONSES					

Introduction to teachers

- 🌐 During one of our regular monthly workshops
 - 🌐 Explained the purpose and resources
 - 🌐 Teachers practiced conducting talks in small groups
- 🌐 Visited each classroom
 - 🌐 Demonstrated a number talk with each teacher's class

Teachers experiences of the number talks

3 sources of data:

1. short questionnaire after classroom demonstration (8 teachers)
 - Questions are shown in the paper
2. Annual end of year teacher questionnaire (\pm 26 teachers)
3. Video of teacher facilitated talks

Some responses

- Experience of number talks
 - learner excitement / fun (3 of 8)
 - active learner participation (4 of 8)
 - access to different learner strategies (5 of 8)
- Future use of talks?
 - useful for progressing slow learners (3 of 8)
 - emphasise strategies and concepts (3 of 8)
 - make it fun/interesting (2 of 8)
 - pushes for efficiency (quicker ways)
 - learning from others (2 of 8)
 - supports oral/mental maths contributions (2 of 8)
 - allows for individual attention (1 of 8).

Yes. Love implementing number talks because these different strategies make maths so much fun and interesting.

Yes, as I said before, the slow learners will also learn at the same time from the fast ones who understand. Learners also learn a quicker way. I like that

Some responses from end of year questionnaire

Many responses pointed to the way number talks enable learners to:




- Develop mathematical talk (3)
- Develop listening skills (2)
- participate actively (3)
- develop learner confidence (3)
- Develop learner enjoyment (8)

Most common responses related to the conceptual development and progression we had built into our number talk approach (11)

Quite amazing. Number talks shows how many things one can do and figure out with numbers. To broaden one's sense about it

Learners are encouraged to talk and their confidence is built and also their thinking and reasoning skills are developed.

Concluding remarks

-  An absence of conceptual development, coherence and progression in lessons:
-  a key contributing factor to South Africa's extremely poor performance across regional and international comparative studies.
-  Many teachers commented that number talks are particularly useful for their so-called 'slower learners' who tend to persist with concrete one-to-one counting methods as through participating in the talks and the follow up activities they are able to learn from fellow learners' more efficient ways of working and be more motivated.