Let's Talk About It. Secrets of Schools Successful in Mathematics

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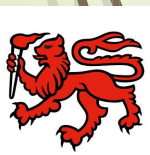


Times past

Aboriginal people had a complex system of mathematics that described

- Family relationships
- Space and time
- Food sharing …

Passed on within the group according to defined rules and protocols in diverse ways

Assessed in various ways including during initiation ceremonies and in public display

This presentation

Based on 3 studies

- What are the characteristics of schools successful in Mathematics? – Best Practice in Mathematics Education (BPME)
- What information helps teachers of Mathematics? – Reframing Mathematical Futures Project (RMF2)
- What do good teachers of Mathematics do in the classroom? – Powerful Knowledge Project

BPME

- National project
  - All states
- Schools successful in **growth** in NAPLAN results – not just performance
  - All systems (government, Catholic, Independent
  - All types of school (Primary, High, Combined school)s)
  - Metropolitan, Regional and Rural schools
  - ICSEA range 899 - 1202
- Surveys
  - Students (Primary Years 3-6 - 591; High School Yrs 7 -10 467)
  - Teachers and leaders (Primary 183; High School 96)
- Case studies
  - 52 Schools (Primary 28; High School 17; Combined 7)

RMF 2

- National Project
- Focus on Years 7 – 10 but earlier projects also included Years 5 & 6
- Findings applicable across all school years
- Provision of evidence based teaching advice
  - Assessment tools
  - Suggested activities for teaching
- Large scale – over 4000 students

Powerful Knowledge

- Australia and New Zealand
- Focus groups of teachers – Primary and High School
- Video data of Mathematics lessons
  - No special preparation
  - No particular topic
- Any teacher willing to be videoed
  - Range of experience
  - Mathematics and English lessons

School level

- ALL children can learn mathematics
  - Not just rhetoric
  - No sense of deficit for students or teachers

School level

- In every successful school mathematics was led by someone who was involved at the school policy level
  - A champion
- School level changes were implemented over a period of years

School level

- We have a collective responsibility to ensure that ALL children learn mathematics
  - Strategies to make this happen

Some strategies that successful schools used

- Regular meetings/professional learning communities where **mathematics teaching was the focus**
  - Planned for e.g., staff meeting
  - Teachers off class together
    - Learning community
    - Lunchtime duty roster
  - Accountability

- Sensible use of data
  - NAPLAN
  - Other sources e.g., PATMaths
  - Classroom assessment
- **Action** based on data
  - School and classroom level

Grouping and regrouping

- Based on data students organised for learning mathematics
  - Different models – with class, across grade, vertically
- Groups were not fixed
  - Not traditional 'streaming'
    - Sometimes grouped so that could extend good students
    - Sometimes grouped because a student was an unusual thinker

- Used their community
  - School farm or garden
  - Maths expos/community activities

NAPLAN in Successful schools

- Recognised both positive and negative aspects
  - Provided useful data
  - Improved school cooperation
- BUT
  - Created stress for students
  - Teachers had to calm students

Teacher practices

- Consistent correct mathematical language
  - Agreed across school
- Student talk
  - Discussion
  - Explanation

Learning the language of maths is exactly the same as learning any language – you need lots of opportunity to speak it!

- Student control
  - "Choose which problem you want to work on"
  - ALL solutions accepted and discussed
- Final lesson wrap up
  - "What can you do/know/understand that you didn't before?"

Tools for teachers

- Many sources of information
  - Formal and informal
- Questioning
  - Posing rich questions (e.g., the work of Peter Sullivan)
- Rich tasks
  - Assessment and teaching become integrated
- Class discussion

ABC stock image

Questions

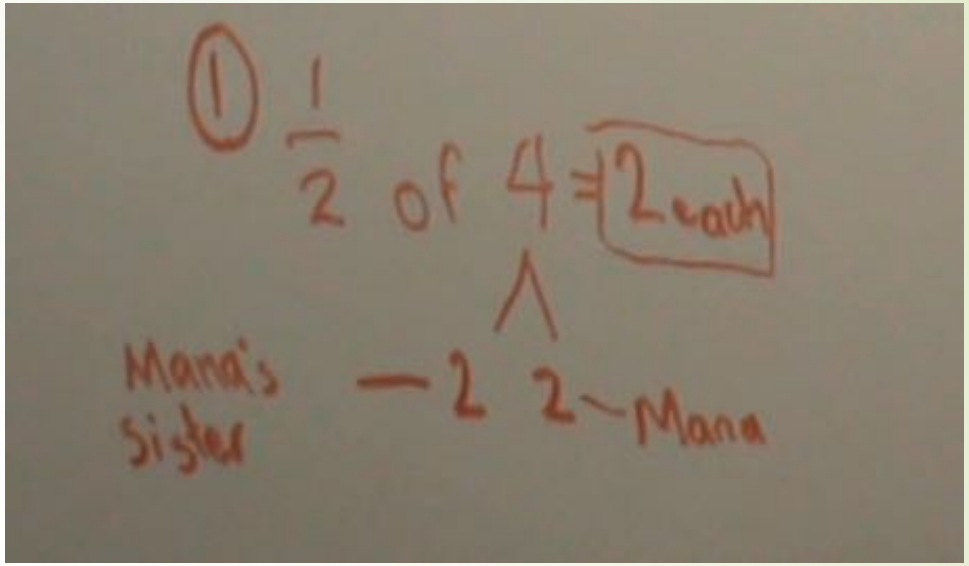
- A visit to McDonalds following a sports game. 3 questions of increasing difficulty
  - 4 burgers were ordered and half of these given to another person.
  - 16 burgers ordered, and one-quarter given to another person.
  - 40 burgers ordered and five-eighths given to another person.
- Children worked in small groups to solve one of the problems (their choice). Year 6 class

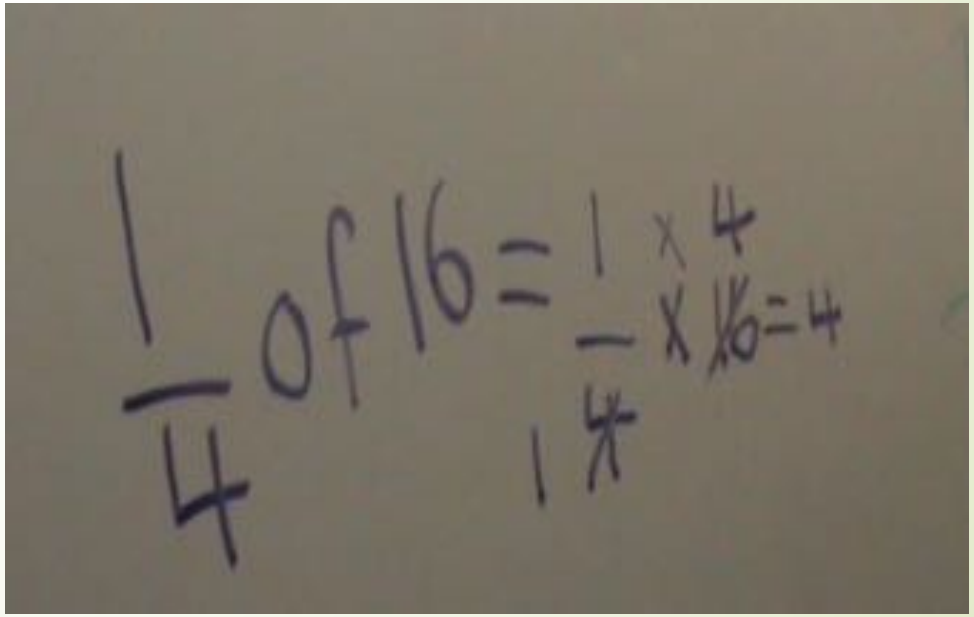
T: So you're imagining that you've got 40 hamburgers. Yes. Okay. And what's the connection to the eight?

S. You're dividing.

T: Okay. Dividing what?

S: To five groups.





A productive process

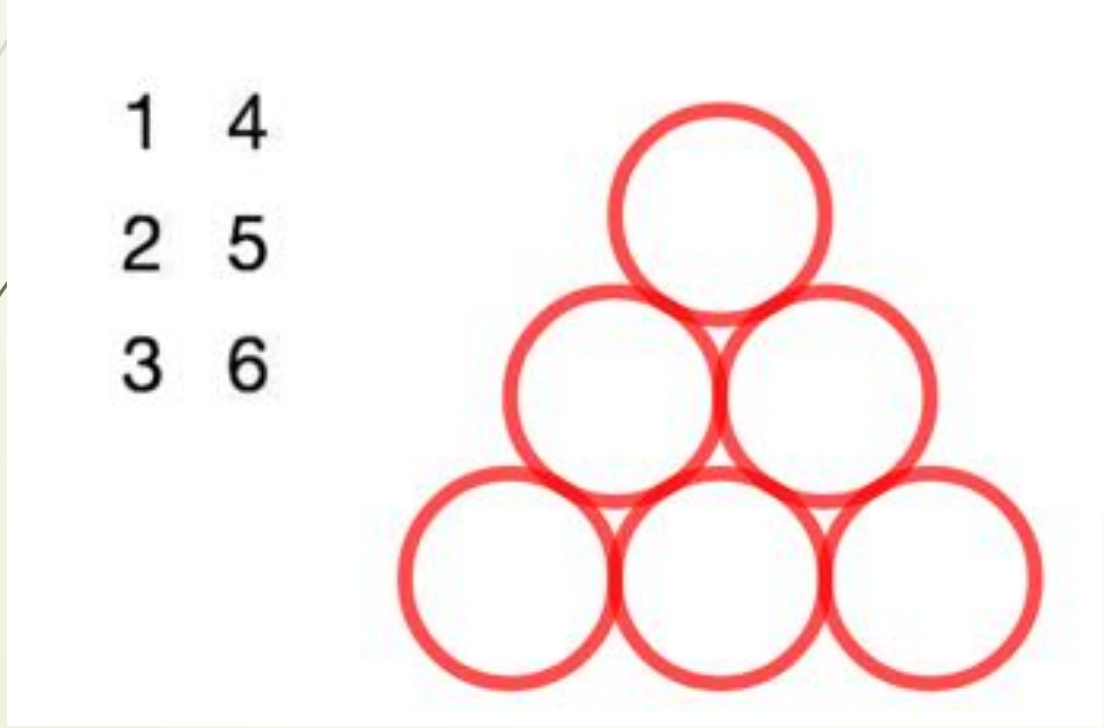
- Questions developed collaboratively by teachers from same grade level
- Lot of emphasis with students on ‘being a learner’
  - Students could ask questions of each other but not give the answer
  - All students in the group had to understand what they had done
  - Random students chosen from each group to report back during the final wrap up

Rich tasks

Rich tasks can enable students to work mathematically by allowing them to:

- **Step into activities even when the route to a solution is initially unclear**
- **Get started and explore because the tasks are accessible to pupils of wide ranging abilities**
- **Pose as well as solve problems, make conjectures**
- **Work at a range of levels**
- **Extend knowledge or apply knowledge in new contexts**
- **Work successfully when using different methods**
- **Broaden their problem-solving skills**
- **Deepen and broaden mathematical content knowledge**
- **See and make sense of underlying principles or make connections between different areas of mathematics**
- **Work within include intriguing contexts**
- **Observe other people being mathematical or see the role of mathematics within cultural settings**

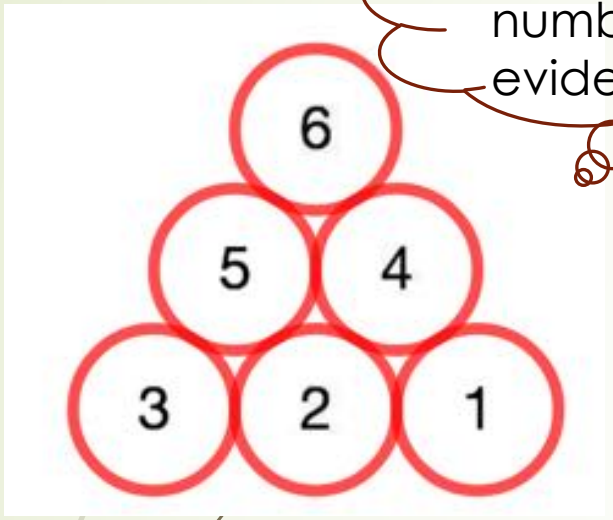
Place the numbers 1 to 6 in the circles so that each number is the difference between the two below it



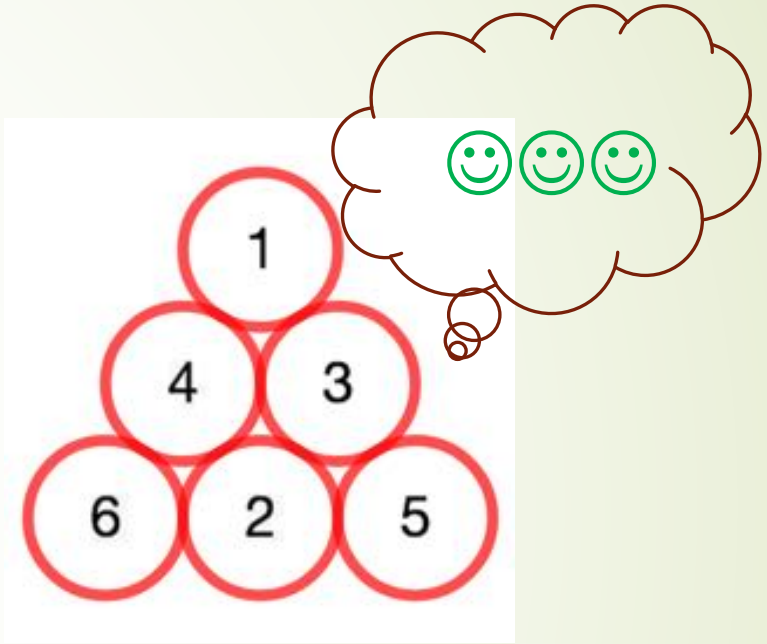
- What responses might your students give?

https://nrich.maths.org/6227

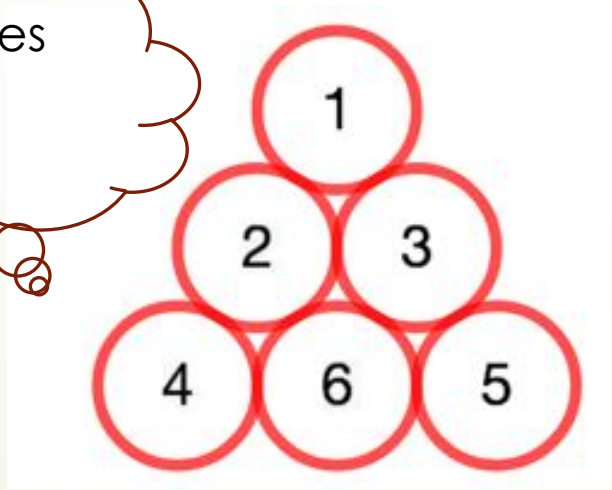
Incorrect but some number knowledge evident



WHAT WOULD YOU DO NEXT?



Top 3 circles correct



Let's talk about it: What does this mean for schools and teachers?

- No single way to teach mathematics
- Sensitivity to context
- Collaboration and discussion
- Variety of approaches to same topic
- Student talk/control

Successful Schools

- Place teachers' professional learning within a mathematics context rather than general approaches
- Shift the focus of teachers' professional learning onto "next steps" with students
- Place "feedback" within a pedagogical rather than an assessment framework
- Trust teachers' judgements

It is quality teachers, making rapid professional judgements on the run in busy classrooms, within a professional and supportive school environment, that impacts on children's interest and involvement in mathematics.