**IPPN Conference 2013** 

## Leading, Teaching and Managing Maths in your School

### Seán Delaney Marino Institute of Education

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### Aspects of Your Job



Busy Red Desk image courtesy of wikimedia commons



Non-educational tasks

- •Paperwork for the DES and other agencies
- •Special Education needs

•Conflicting demands on teaching principals between teaching and leading

- Lack of resources
- •People management staff, pupils, BoM, parents
- •Lack of support from in-school management team
- Unplanned interruptions
- •Maintaining full complement of teaching and non-teaching staff
- Revised curriculum
- •Inactive or ineffective BoM
- •Legal/litigation culture

IPPN, 2004

### Aspects of Your Job that Relate to Mathematics



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### When Might You Think about Maths?

- Daily for teaching principals (but from a teacher's perspective rather than that of a principal)
- When you complete your SSE
- When a WSE is imminent
- When you decide to revise the school plan
- When you're checking fortnightly/monthly reports
- When an inspector comments on the standard of maths/maths teaching in the school
- When a teacher complains about the different levels of maths "ability" in their class
- When a teacher suggests splitting up 4<sup>th</sup>, 5<sup>th</sup> or 6<sup>th</sup> class by "ability" for maths teaching
- When you receive the SIGMA/Drumcondra results for the year
- When a parent asks what approach the school takes to teaching subtraction/tables etc. either one-to-one or at a parents' meeting
- If you are organising a whole-school maths event (Maths day/week, trail)
- Identifying and using a talented teacher of maths in your school
- When you attend a workshop such as this one

 Daily for teaching principals (but from a teacher's perspective rather than that of a principal)

## **Teaching Maths Every Day**

 Encourage children to do the mathematical work in your class – explaining, reasoning, connecting ideas

• Welcome mistakes







### Principles in Responding to Children's Errors

- Making errors is a natural part of learning mathematics
- Errors provide insights into children's understanding of mathematical ideas
- If errors are not made visible, a teacher cannot address them
- Children don't get "confused" by talking about mistakes

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### Strategies for Responding to Errors

- Encourage language of agreeing and disagreeing with ideas rather than saying that someone is right or wrong
- Thank children for bringing up something that is potentially confusing for others
- If children don't raise potential errors, refer to another class you taught where some children thought that.... Ask: Why might someone think that ....
- Follow up by discussing "how can we help the children in this class to remember that...?"

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### When you're doing a SSE

### When a WSE is imminent

### When you decide to revise the school plan



### Questions to Clarify and Change Practice

- **1.** How are number facts tables taught and tested throughout the school?
- 2. What algorithms (recipes for doing calculations) for each operation are preferred/used?
- 3. How is children's mathematical language developed?
- 4. How are problems used in class and where can you get good problems?
- 5. How are individual differences accommodated?
- 6. What opportunities do staff have to develop their teaching methods and their own mathematical knowledge?
- 7. How are children's mathematical skills developed?
- 8. How do teachers motivate children to learn maths?
- 9. How is maths assessed?
- 10. What kind of written and oral feedback do learners receive?
- 11. How do textbooks help teachers in responding to the questions above?
- 12. What role is envisaged for parents in developing their children's knowledge of mathematics?
- 13. What do you want to achieve in teaching maths?

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### Inserted after Discussion on Subtraction (Thursday) 1

"Borrow and Payback"

- Is a highly efficient algorithm that works for awkward numbers such as 2003 – 167.
- Correct name is "equal additions" and is based on idea that if you add the same number to the minuend (2003 above) and the subtrahend (167 above), the difference remains the same.
- Language of "borrow and payback" doesn't map well to what you are doing mathematically and makes little sense. Better to use language of adding a ten to both numbers (in the units column of the top number and the tens column of the bottom number)
- Approach was widely used in Ireland before revised curriculum and so is known by many teachers and parents
- Is often taught without referring to its underlying mathematical logic

### Inserted after Discussion on Subtraction (Thursday) 2

- Decomposition (regrouping, renaming)
- Makes visible the hundreds, tens, units etc. structure of numbers
- Uses language of exchange (I can exchange one ten for ten units)
- Language of exchange maps well to other topics (e.g. In 321 ÷ 4: In their present form, I cannot share three hundreds equally among 4 people, but I can exchange the 3 hundreds for 30 tens...; or in 2 hrs 21 mins 1 hr 45 mins: "21 minutes minus 45 minutes, I cannot do but I can exchange one hour for sixty minutes, 81 minutes minus 45 minutes equals...; or in 3 ¼ 1 ¾: "¼ minus ¾ I cannot do. I can exchange one unit for four quarters, five quarters minus three quarters...)
- Relates well to base ten materials
- All the changes take place to the top number
- Better to use informal methods than this algorithm for calculations such as 2003-167

Inserted after Discussion on Subtraction (Thursday) 3

If you are still wondering whether to go with decomposition/regrouping/renaming or borrow and pay back/equal additions, here is a third option. Allow the children to invent their own ways of subtracting!

http://www.youtube.com/watch?v=cz4t51wBGI

### When You're Checking Fortnightly/Monthly Reports



## **Responding to Monthly Reports**

- "Addition of fractions same denominators, improper fractions only"
- "Introduced number 3"
- "What did you do to promote children's .... Problem solving, communicating, reasoning, integrating and connecting?



## When an Inspector Comments on the Standard of Maths/Maths Teaching in the School



### **Inspector Comments**

- The quality of learning, teaching and pupil attainment in Maths is very good. Mathematical language is developed consistently and excellent use is made of mathematical resources to assist concept development. Competence in mental arithmetic and acquiring number facts are emphasised. The pupils engage actively in their learning and show a positive attitude to Maths. Most pupils apply their knowledge successfully across mathematics strands. The consistent promotion of higher order and problem-solving skills is praiseworthy.
- Place more emphasis on enabling the pupils to solve everyday problems collaboratively and on using suitable resources. All lessons should incorporate more extensive, participative oral work across all strands, especially *Measures*.
- Develop further problem solving strategies in the school.
- Recent initiatives to improve attainment in problem solving is welcomed and how these are implemented should be monitored in a more structured manner. More attention should be directed to developing the pupils' mathematical language and ensuring an explicit connection between the pupils' own environment and the pupils' learning.

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### **Problem solving Strategies**

- RUDE (Read, Underline, Draw diagram, Estimate)
- STAR (Search the word problem info; Translate the words into an equation or picture – plan; Answer the problem – solve; Review the solution – check.)
- LUV2C (Look, Underline, Visualise, Choose numbers, Calculate)

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## Learning Problem Solving

- The best way to become good at problem solving is to practise solving problems
- Skill in problem solving develops slowly over time
- Most textbooks have too many problems and their quality is flat
- Problems can be used to introduce new content as well as reinforce it

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## A Good Problem

- Should leave the solver feeling "stuck" at first
- The maths is what makes the problem problematic
- Relates to the children's experience
- Connects different maths topics
- Allows children with different attainment levels to achieve success with it
- May take time, even days, to complete
- Requires children to justify and explain their answers and methods

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### Mathematical Language

Angle	Difference	Even	Face
Factor	Improper	Mean	Metre
Negative	Net	Odd	Of
Positive	Power	Prime	Product
Rational	Record	Reflection	Share
Similar	Sum	Take away*	Variable
Volume			

\*suggested by a teacher at Thursday's session

An Associated College of The University of Dublin, Trinity College

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### Mathematical Language



\*suggested by a teacher at Thursday's session

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When a teacher complains about the different levels of maths "ability" in their class When a teacher suggests splitting up 4<sup>th</sup>, 5<sup>th</sup> or 6<sup>th</sup> class by "ability" for maths teaching



# Should children be grouped for teaching maths?

Maths

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and Love

- Grouping by class for maths is a necessity in many settings
- "ability grouping in primary schools had no academic benefits and severe negative consequences for children's development." (p. 97)
- In-class grouping

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# Problems with "Ability Grouping" at school level - Setting

- No consistent effects on attainment
- When structured ability grouping is used children in top group(s) tend to work at a faster pace and have higher teacher expectations whereas for children in lower groups topics may be omitted and activities restricted; these children experience work that they find is too easy.
- Children in higher and lower groups may experience teasing and children in lower groups may be stigmatised
- No consistent effects on self-concept or on social mixing but children perceive that they help each other more in mixed ability settings.
- Allocation of children to groups can be somewhat arbitrary and often depends on factors not related to attainment
- In theory movement between groups is possible but in practice it is usually restricted
- Pupils are aware of the grouping structures adopted in their schools and accept the rationales for them.

Blatchford, Hallam, Ireson, Kutnick & Creech (2010)

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# In-Class Grouping ("ability" or "mixed ability")

- Is one of three contexts where pupils can learn: teacher-led work, individual work, interactions with other pupils.
- Offers flexibility different groups for different activities
- Makes it easier for movement across groups if groups are structured by "ability"
- BUT in the UK (not sure about research here) little group work takes place and still less of it is of good quality



### Improving In-Class Grouping for Maths Teaching in Your School



Book is not specific to maths

### PART 1

- 1. Background
- 2. The case for group work
- 3. How is your classroom organised
- 4. Preparing the classroom for successful group work
- 5. Developing pupils' group-work skills
- 6. Creating effective group-work activities and tasks
- 7. The role of the teacher and other adults in supporting group work
- 8. Evaluating group work
- 9. Using group work in the curriculum
- 10. Troubleshooting: resolving common group-work problems

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# Creating effective group-work activities and tasks



- •Give groups a single copy of the instructions
- •Have groups work on one single output
- •Withhold resources to allow time for group planning
- •Have tasks ambiguous and open-ended to encourage children to explain ideas to each other

•Structure group-work by splitting a task into sub-activities, by snowballing, or allocating roles (scribe, chairperson, spokesperson)

### Improving In-Class Grouping for Maths Teaching in Your School



### PART 2

- 1. Group work and group-work rules
- 2. Sensitivity and awareness
- 3. Developing trust
- 4. Sensitivity, respect and sharing views
- 5. Becoming a good listener
- 6. Listening, asking questions and giving instructions
- 7. Helping skills
- 8. Group discussion: giving reasons and weighing up ideas
- 9. Group discussion: making suggestions and speculating
- 10. Group discussions: reaching a consensus
- 11. More decision-making: consensus and compromise
- 12. Roles within group work
- 13. Planning group work

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### Group Discussion: Giving Reasons and Weighing Up Ideas



- Lesson format: briefing, group work, debrief and follow up
- Sample group work: Junior classes: choose a place for the class to visit, say why it was chosen; Senior Classes: Debate, with reasons a topic such as "Zoos are good places for animals" or "Dropping litter keeps people in a job."

3. Phrases used in reasoning and what it does: "Why? (Requests reason)

"How about....because..."

"I think.... Because..."

"If ....then..."

(Suggestion plus reason)(Opinion plus reason)(Exploring reasoning)

"No that can't be right because .... so ... "

(Exploring implications of an argument) "I understand your point of view but..."

(Raising alternative interpretation)

### Some sources of Open-ended problems for Group Work

The two sites I recommend every year are: <u>http://nrich.maths.org/frontpage</u> (British based, very good and free) <u>http://www.nctm.org/</u> (U.S. Based, very good but needs annual membership. The annual membership comes with a subscription to your choice of an NCTM journal – the most relevant to primary teaching is *Teaching Children Mathematics*).

This site has several suitable problems - but they are geared towards the senior end of the school:

http://www.uky.edu/OtherOrgs/ARSI/www.uky.edu/pub/arsi/openresponsequestions /mathorq.pdf

This is a page for home schooling but it has links to some good sites: <u>http://www.homeschoolmath.net/online/problem\_solving.php</u>

This site is an article and there is one or two problems mentioned in the article that you might consider using:

http://eprints.utas.edu.au/4822/1/4822.pdf



## When you receive the SIGMA/Drumcondra results for the year



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## Standardised Test Results (1)

From Assessment in the Primary School Curriculum

- "The results of standardised tests are generally used in primary schools in Ireland for the following purposes:
- to identify children with learning difficulties so that appropriate supports can be put in place..."
- "to identify children with exceptionally high scores so that appropriate learning experiences can be provided for them
- to report to parents on their children's achievement and progress."
  The document states later:
- "Teachers may look at a set of class results to see whether any significant patterns or features are apparent."
- "School-wide results are also useful as they might indicate the need for attention to particular skills or areas of learning across different class levels."



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## Standardised Test Results (2)

 "There is widespread acceptance of the value of standardised testing as one of a range of modes of assessment that help teachers to make more informed decisions in relation to teaching and learning. The results of standardised tests can be used to inform parents of pupils' progress and to assist in the identification of pupils that may require support." Circular 138/2006 (My highlighting)

"We can improve the way we use information from standardised tests to improve literacy and numeracy." (Literacy & Numeracy for Learning and Life, p. 76)



Some Factors Other than Schooling that Affect Standardised Test Results

- Family stability
- Parental involvement and expectations for success in school
- Early and ongoing home stimulation
- Student motivation
- Student absenteeism
- Student capacity for learning

(Simner, 2000)

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### Archives

### None of us wants this here:

#### INVESTIGATOR SAYS TEACHERS IN CITY AIDED IN CHEATING

By ABBY GOODNOUGH Published: December 08, 1999

School investigators charged yesterday that dozens of teachers and two principals across New York City's public school system had given students the answers on the standardized reading and mathematics tests that help determine how schools are ranked and whether students move on to the next grade.

The cheating, in grades three through eight over five years, involved more students and educators than any recent cheating case in American public schools, the investigators said.

At some schools, teachers and principals let students mark their answers on scrap or notebook paper, then told them which answers to correct when they filled in the bubbles in the official test booklets, the investigators said. At others, they directed students to erase incorrect answers, or even changed the answers themselves.

The New Hork Times

Education

etienters and that in a newtienlawly conscious case. Finder Hay the primatel of Public School 234 in the Bronx, not only told third uestions from the actual exam.

two were even removed from a statewide list of failing

. Hey and others were using the cheating techniques, a

reers by creating the illusion that they were doing a good

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against the teachers and principals.

#### Prosecutor Says Indictment of Austin Schools Will Help Deter Test Tampering

By BARBARA WHITAKER Published: April 08, 1999

The county attorney in Austin, Tex., said today that indictments against the city's school district and a top administrator for manipulating statewide assessment tests scores were a hard but necessary measure to prevent tampering.

Ken Oden, the Travis County Attorney, said the indictments handed A nationwide school coalition said the charges were believed to be tl

"The reality is that as we rely more on standardized testing and stan emphasis on obtaining the best possible rating for your school and s manipulate the data in a way to create the most favorable image for

In Austin, he said, district officials succumbed to that pressure last s Skills test, which is used to rate the performance of both students ar Frenzy over tests breeds an outbreak of cheating poor performance can be an embarrassment to a district, and a temp

In two separate 16-count indictments, a grand jury charged that the **By JAY MATHEWS** in altering government records. A third district employee, Ricky Arr and AMY ARGETSINGER, The Washington Post changed the records, pleaded no contest to charges of altering gover June 03, 2000 2:00 AM

The indictments say changes were made in identification numbers cThe pressure to raise students' scores is blamed for cases of coaching by teachers.

Typically, Social Security numbers are used, but when those are not

period when, if an identification number was changed, the test score Fifth-grade teacher Barbara McCarroll was already puzzled and a little upset about her students' low test scores ID numbers of 16 low-scoring students were changed so their scores when her boss at Eastgate Elementary in Columbus, Ohio, approached her. Institiúid Oideachais 🛛 👍

#### Also:

http://www.pbs.org/wgbh/pages/fron tline/education-of-michelle-rhee/

How was it, the principal snapped, that the same children had done so much bette vear before?



### Improving Mathematics Attainment with Standardised Test Results

At School Level

- Correlate test results with student <u>attendance</u> (and show and explain the <u>relationship</u> to parents)
- Look at scores of subgroups in the school (e.g. boys/girls, students attending learning support/resource teaching, English language learners), reporting on contexts (such as differences in how test was approached)
- Other?

At Class Level

- Ask teachers to write a commentary on the results based on their knowledge of the children and other assessment data they have
- Correlate children's exact ages (in days) with results (e.g. Some children in your second class were 8 on 1<sup>st</sup> September and some are not 8 until 31<sup>st</sup> August next)
- Other?





## Relationship between test scores and attendance







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From: http://www.ncca.biz/guidelines/assessment/assess\_intro.htm



### When a parent asks what approach the school takes to teaching subtraction/tables etc. either one-toone or at a parents' meeting

(See <u>http://seandelaney.com/presentations/</u> for a presentation you can use at a meeting for parents)



## If you are organising a whole-school maths event (Maths day/week, trail)



### Maths Adventure Games by Alan Parr



### All the above are available from amazon.co.uk



### Other Whole-School Maths Events

- Maths Trails around the school or your local area see question prompts here: <u>http://seandelaney.com/wpcontent/uploads/2011/06/Question-Prompts-for-</u> <u>Maths-Trails.pdf</u>
- Set up maths stations in the hall and have children move from one to the other. You could include tangrams, pentominoes, and other equipment. A website such as this one may stimulate some ideas: <u>http://www.kidscount1234.com/mathcentersandgame</u> <u>s.html</u>. Choose activities that have the potential to promote mathematical skills such as reasoning, communicating and problem solving



## Identifying and using a talented teacher of maths in your school



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### Tapping into Teachers' Talents and Interests

- How do you identify potential subject leaders in your school?
- Who can lead your school planning in maths?
- Who would appreciate encouragement to engage in professional development in mathematics?



### **Contact Details**

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## **References & Further Reading**

- <u>http://www.principals.org/portals/0/content/48874.pd</u>
  <u>f</u>
- <u>http://www.usc.edu/dept/education/cegov/focus/education-reform/publications/books-chapters/Achieving%20with%20Data-How%20High%20Performing%20Schools%20Use%20Data%5B1%5D.pdf</u>
- <u>http://www.usc.edu/dept/education/cegov/focus/education-reform/publications/books-chapters/Achieving%20with%20Data-How%20High%20Performing%20Schools%20Use%20Data%5B1%5D.pdf</u>

## Images Sourced from

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- <u>http://www.nytimes.com/1999/12/08/nyregion/investigator-says-teachers-in-city-aided-in-cheating.html?pagewanted=print&src=pm (6-1-13)</u>
- <u>http://www.nytimes.com/1999/04/08/us/prosecutor-says-indictment-of-austin-schools-will-help-deter-test-tampering.html?pagewanted=print&src=pm</u> (6-1-13)
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- <u>http://homepage.usask.ca/~dln136/correlation/pages/correlation1.</u> <u>htm</u> (8-1-13)
- <u>http://aboutteaching.wordpress.com/tag/school/(20-1-13)</u>