Making Maths Matter
What Matters?

East Lothian
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Louise Hayward.
Professor of Assessment and Innovation.
Making maths matter - Closing Gaps

Myths around closing the achievement gap

Research evidence on closing the achievement gap

Our International Quest for Mathematics literacy
  • Research findings beyond Scotland
  • Research findings in Scotland (Carolyn)

Mathematics for All – a bigger picture

Sustainable change in Mathematics
Myth - The secret of Finland’s educational success lies in its classrooms

Reality – The 20 year strategic plan
International Myths about Achievement

Myth – PISA has had a major influence on improving learning

Reality – PISA has had a major impact on changing policy
Myth – PISA is culturally neutral

Reality – 15 year olds in Shanghai are applauded into sitting the PISA test

- 15 year olds in Scotland see PISA as another day at the office
Address the issue holistically

- Home Circumstances
- Personal Circumstances
- Educational Circumstances
Making Mathematics Matter – home circumstances

- Context where learning can matter – freedom from hunger, fear, cold, overwhelming debt, violence, abuse

- Parental or carer support – passive (school is a good thing) active (learning with children)

- What else?

- How might we promote these rights for every child? How might we support families in dignified ways?
In Scotland today, at age 5, the gap between children from the most advantaged and most disadvantaged families is already:

- 6-13 months in problem-solving ability
- 11-18 months in expressive vocabulary

Edinburgh; Scottish Government
• I believe I can

• I understand what matters and why

• I am part of a community where we want one another to learn and I believe my learning matters to other people

• I have an understanding of progression, am able to identify progress I have made, what to do next and how to make further progress

• What else?

• How might we promote these rights for every child? How will we know?

• Dweck, Growth Mindset; ARG, Assessment Purposes and Persons
Birth – 18

• Before 3?

• Early Years – every child has opportunities to play purposefully mathematically; there is a focus on equity rather than equality; issues emerging are addressed quickly paying attention to the dignity of every person; focus is on learning rather than diagnosis

• What else?

• How might we promote these rights for every child?

Evidence from Number Counts (Carolyn Hutchinson)
International Myths about Achievement

- Schools can do little but despair given the circumstances

Teachers can make a huge difference to the achievement of young people
Effective classroom strategies for closing the gap in educational achievement for children and young people living in poverty, including white working-class boys

Jonathan Sharples Robert Slavin Bette Chambers (Institute for Effective Education) Caroline Sharp (NFER)

Findings from the best-evidence synthesis of international, experimental research identify some common classroom strategies that work across different subjects and educational phases:
Mentoring teachers in new teaching strategies significantly raises outcomes for children living in poverty. Research-proven approaches include cooperative learning (structured group work), assessment and meta-cognitive (‘learning to learn’) strategies.

Classroom interventions that close attainment gaps for children living in poverty adopt proven classroom management strategies (e.g. rapid pace of instruction, using all-pupil responses, developing a common language around discipline).

The most powerful improvements in achievement are produced through the use of well-specified, well-supported and well-implemented programmes, incorporating extensive professional development.
• Key issues in learning mathematics and how different approaches to assessment impact on mathematics development
Key Issues in Raising Achievement in Mathematics

- School – the power of assessment

- The impact of labeling

- Socio-cultural learning (AifL, Co-operative learning, Learning Rounds)

- Key ideas – children and young people as learners, researchers as learners, policy makers as learners

- The impact of different policy drivers
Key Issues in Raising Achievement in Mathematics

• The role of the learner – choice matters

• The right to be involved in co-constructing the curriculum, eg choosing texts, designing tasks

‘Say if our teacher chooses our topic, like castles that we did last term, we got to choose what we are going to learn about it and where we were going to do it and where we were going to get information from.’

‘if we do what we want to do, then we’ll learn it better but if it is all the teacher’s idea, then maybe we’ll. say, hmmm.....’

To what extent is it possible to build an element of choice into mathematics?

Hayward, Boyd, MacBride & Spencer (2009) Just Making them Think
Key Issues in Raising Achievement in Mathematics

- The role of the learner – collaboration matters
- The right to be involved in supporting one another

Learners emphasised the importance of teacher explanations but most commonly effective learning was linked to peer explanations.

‘I like the explaining as well, it helps you learn...’ and for the recipient of the explanation

‘I would work with Liam because I sit right beside him and usually if I get stuck I just talk to Liam because usually he’s near the same questions as me, we’re in the same level and I find it a bit easier because he knows what we’re trying to do....’
The Importance of Narrative – ideas out loud

Example One: Give your students a paragraph of ‘waffle’

The shape I’m describing has four straight sides. Two of the sides point in the same direction and wouldn’t cross if they carried on forever. You can’t fold the shape in half so each side perfectly matches up with the other. If you turn the shape around it won’t look the same as it did at the start until you’ve gone all the way around.

Ask them to re-write the paragraph with as few words as possible using mathematical vocabulary

A trapezium is a quadrilateral. It has one pair of parallel sides, no lines of symmetry and no rotational symmetry.
Recognise the Importance of Story Telling

Example Two: Tell mathematical stories

A teacher, Mr Büttner once gave a pupil, Carl Fredrich Gauss, a punishment for being naughty. He was to count up all the numbers between 1 and 100.

The teacher was astonished when the boy came back in two minutes with the answer! How did he do that? Sequences….

\[1 + 100 = 101; 2 + 99 = 101\ldots\ldots50 \text{ pairs } \times 101 = 5050\]
Example Three: You never know anything better than when you have to teach it.

Ask the students to work in pairs and to take turns explain a process to one another.

One talks – the other listens and tries to follow the steps….did it work?
ICCAMS (‘Increasing Competence and Confidence in Algebra and Multiplicative Structure’), Focus on Mathematics – Jeremy Hodgen (Nottingham University)

Algebra: Lesson 1 STARTER

Which is larger, $3n$ or $n + 3$?
Commentary

The aim of this starter is to see what approaches students use to compare algebraic expressions.

- Do students understand the algebraic notation?
- Do they focus on the operations (‘multiplication makes bigger’)?
- Do they evaluate the expressions for specific values of \( n \)?
- Do they respond to the fact that we don’t know the value of \( n \)?
- Do they realise that the difference between the expressions might change as \( n \) varies?

*Use the starter a few days before teaching the two lessons.*
Olaf is spending the day at a lake. He wants to hire a rowing boat for some of the time.

Freya’s Boat Hire charges £5 per hour. Polly’s Boat Hire charges £10 plus £1 per hour. Whose boat should Olaf choose?

**Summary**: In this lesson, the boat hire problem is used to explore the two algebraic relationships underlying Freya’s and Polly’s different hire charges.

A variety of representations are used to express the relationships: everyday language, algebraic expressions, tables of values, points on a Cartesian graph.
Mathematical Ideas

When we work with equations, we often think of a letter as representing a single number as yet unknown. Here, we are working with relations between two variables (the number of hours and the charge) and we think of the letters as representing a set of numbers.

Students’ Mathematical Experiences

Students might discover some of the following for some values of $a$, Freya’s hire charge ($5a$) is larger than Polly’s ($10+a$), but for others it is smaller.

Assessment and Feedback

Choose some students to contribute to a subsequent discussion. Some (less confident?) students’ contributions may be more coherent if you “rehearse” with them beforehand: “That’s a great idea.”
What matters in making maths matter in sustainable ways
Learning from our past

The Innovation Cycle?

Mathematics across the curriculum

Standard Grade – certification for all

Education 5-14
– a coherent, progressive
  shared curriculum
– Assessment Teachers’ Professional
  Judgement central

SPMG Individualised Learning

Higher Still – addressing the academic/
  Vocational divide
The Innovation Cliff

Divergence from aspirations

Moves towards industrial action

Accommodations that led the Innovation away from its original aspirations

Need for further innovation

Individual projects or programmes rather than direction of travel involving pupils, parents, teachers, schools, communities (local and policy)
What leads us to Innovation Cliffs?

Complication rather than clarity
Compliance rather than professionalism
Manageability rather than vision
Accountability - driver rather than lever
Learning from our past

How to avoid the Sisyphus Syndrome?

- A desire to address issues of numeracy and social justice is not new

- Being condemned forever to push boulders uphill only to have them roll back down
Thank you for the invitation to share ideas with you

...............I look forward to the discussion


Hayward, L, Boyd, B, MacBride, G & Spencer, E. (2009) Just Making them Think, Highland Council
