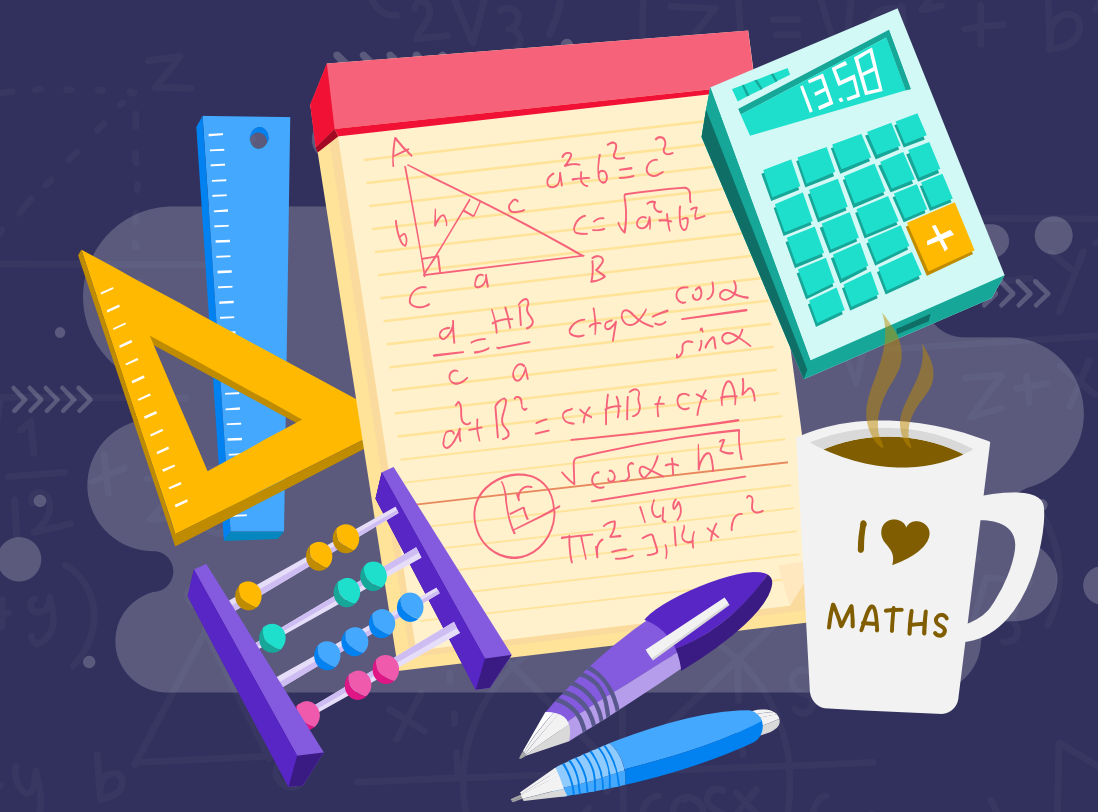
Practicality or Pedagogy?



Exploring the rationale Primary Mathematics teachers give for using manipulatives in their classrooms

Simon Sheard

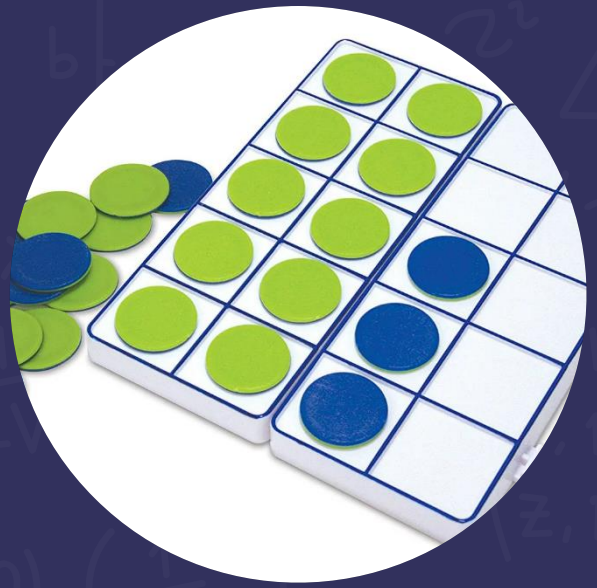
Senior Lecturer in Education

University of Sunderland

Programme Leader for Distance Learning (International) PGCE

- Over 60 countries
- Community, State and International Schools
- Placement trainees, non-teaching staff and experienced (unqualified) teachers
- Mirrors most aspects of our on-campus ITT provision

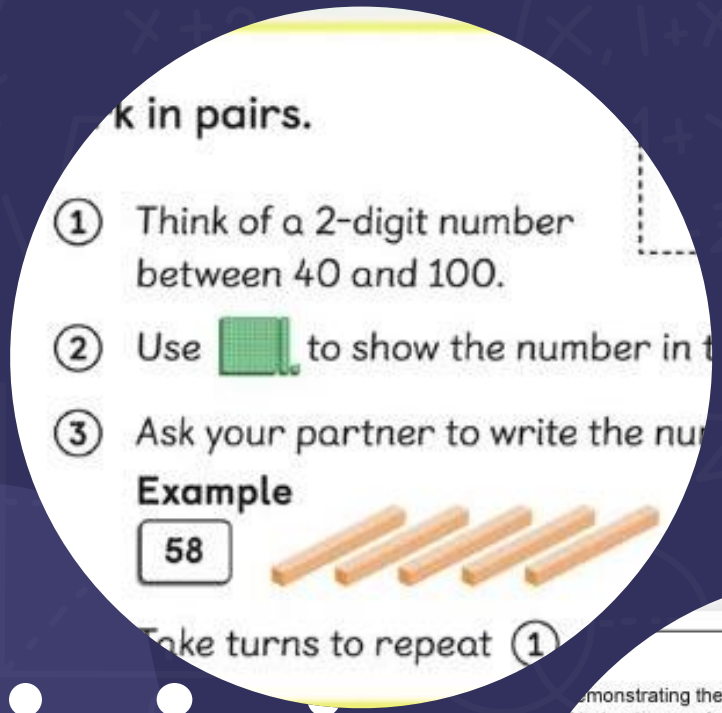
How do primary mathematics teachers' perceptions of Teaching for Mastery (TfM) inform their choices when selecting and using manipulatives (concrete resources) within their lessons?

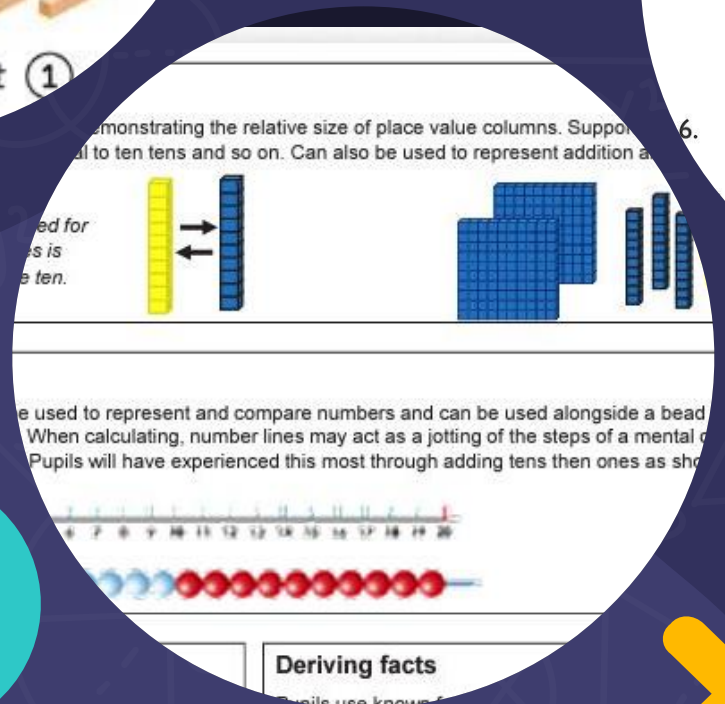


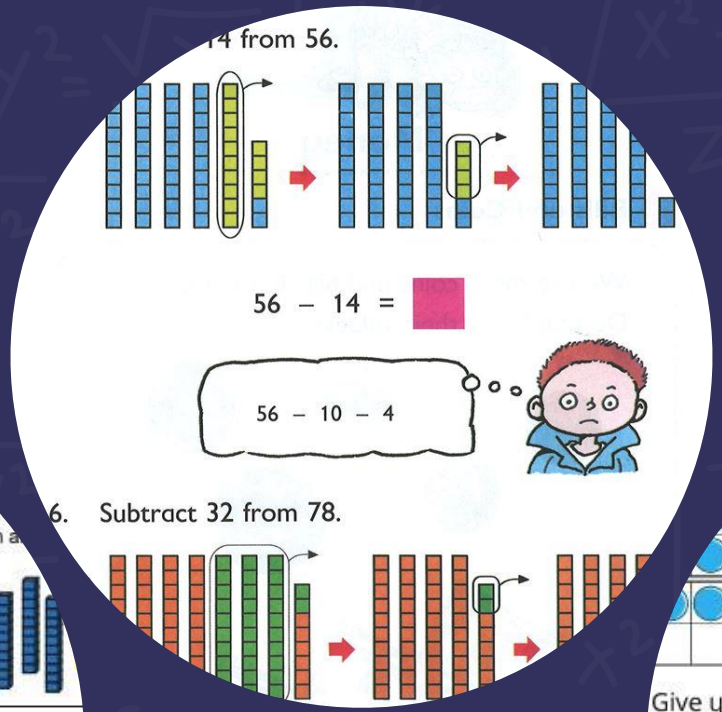
MANIPULATIVES

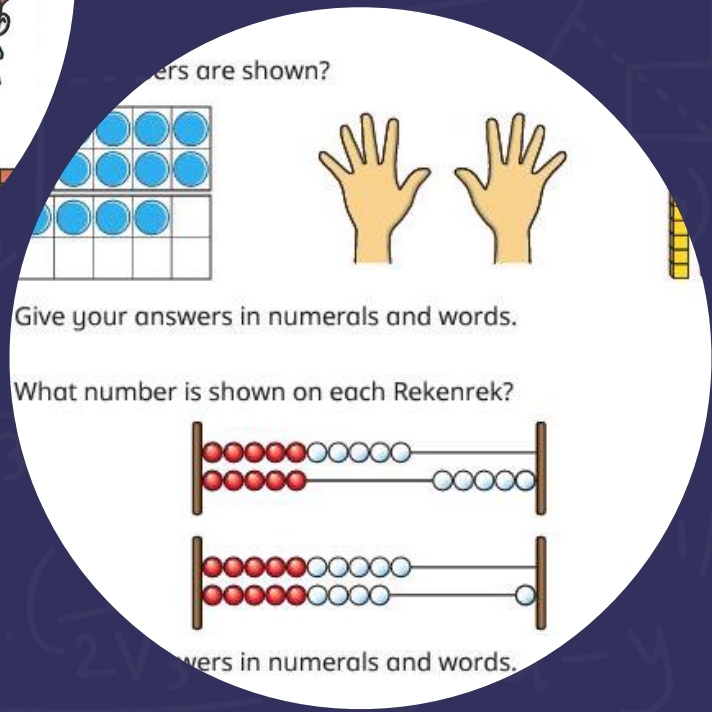
Choice overload?

Supporting resources





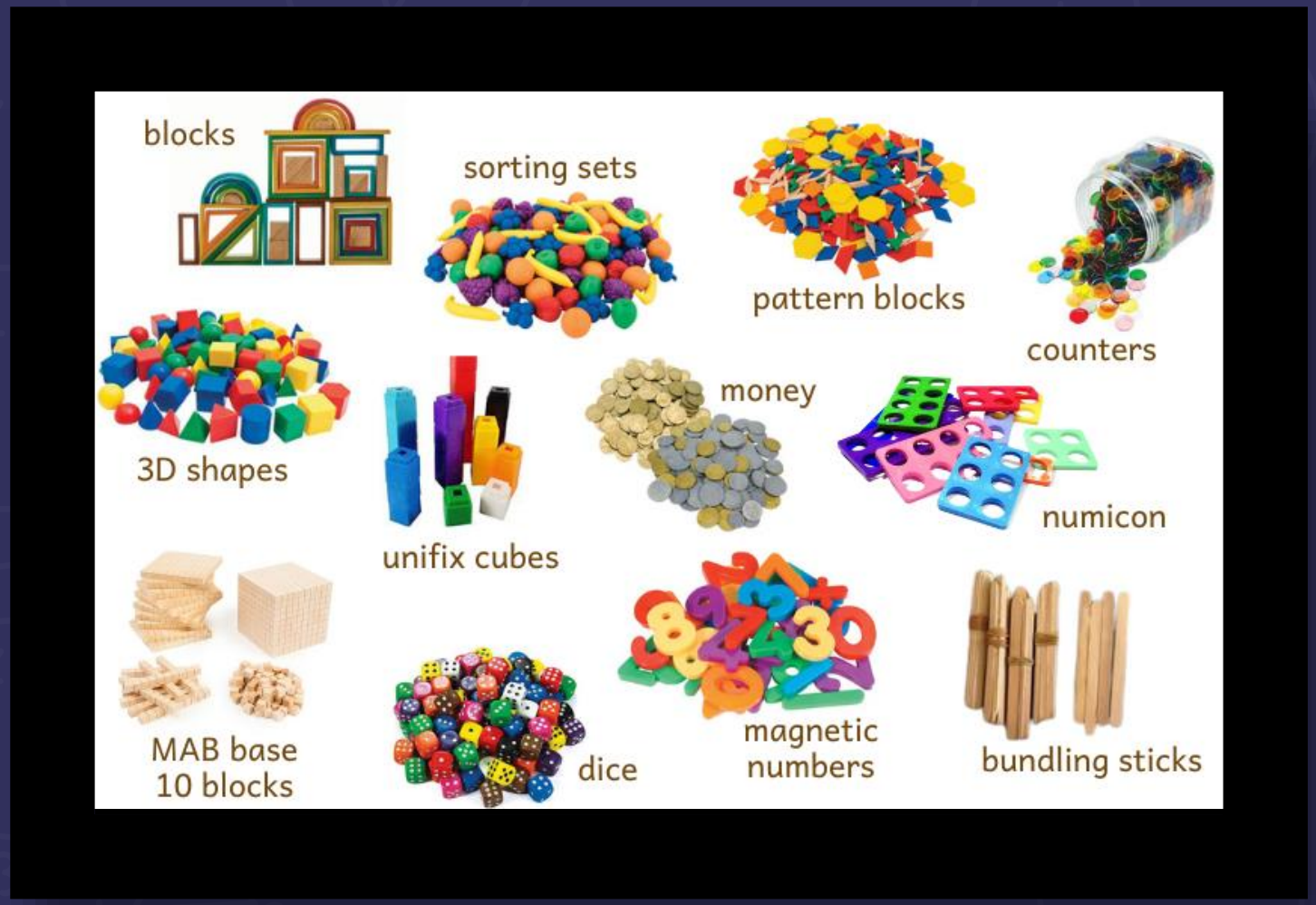




- Carbonneau, *Marley & Selig* (2013) highlight the importance of effective instructional strategy in the use of manipulatives to improve achievement.

- Success is dependent upon:
  - ✓ The level of instructional guidance
  - ✓ The type of manipulative
  - ✓ The age of the learners
  - ✓ The learning environment

- 'Manipulatives are not magic… [they] are not, of themselves, carriers of meaning or insight' (Moyer, 2001, p. 176).



Carbonneau, K.J., Marley, S.C. and Selig, J.P. (2013). A meta-analysis of the efficacy of teaching mathematics with concrete manipulatives. Journal of Educational Psychology, 105(2), pp.380–400.

[Maths] Mastery – are we all on the same page?

Duckworth et al. (2015)

Mastery in theory may be easier to define than in practice

National Association of Mathematics Advisors (2015)

We suggest that idea of the existence of a single definition is a myth.

Garry (2020)

The first thing to bear in mind about mastery is that it is a contested concept. There are fierce battles being waged (online and in person) about what mastery means, and about what does or does not constitute a mastery approach.

TENSIONS

DEFINTIONS

See previous slide

KNOWLEDGE

"we have no problem [in the UK] with allowing a great number of teachers with little deep subject knowledge to teach maths to primary-age pupils" (Garry, 2020, p. 17)

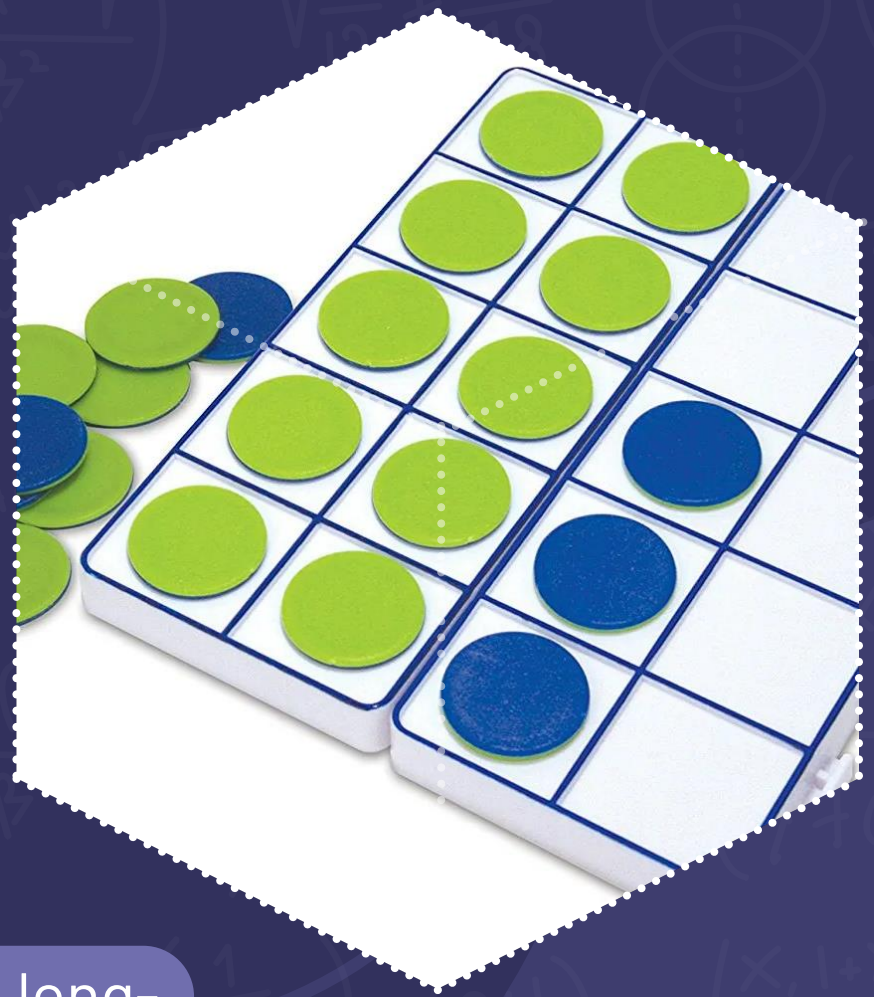
EXPORT

"despite difficulties in even defining the concept of an 'East Asian teaching method', policymakers continue to believe this to be a key reason why mathematics achievement is so much greater in the East than the West" (Jerrim & Vignoles, 2015, p.5)

IMPLEMENTATION

the disconnection between educational recommendations and teachers' beliefs (Golafshani, 2013)

Teaching for Mastery (TfM)



- Based on the *Learning for Mastery* ideas of Benjamin Bloom (1968) and 'Mastery' curricula which are popular in South-East Asia
- Questioned by some as policy borrowing, e.g. Clapham & Vickers (2018)
- Mastery has since undergone "numerous remasters, remixes or mash-ups" (Boylan, 2019, p.14)
- Introduced by the National College for Excellence in the Teaching of Mathematics (NCETM) following the introduction of *National Curriculum 2014*

Mastering maths means pupils acquiring a deep, long-term, secure and adaptable understanding of the subject.

ncetm.org.uk

MathsHUBS

Two years contributing to research and innovation work groups with the local Maths Hub:

- What Manipulative When? (2021-22)
- Which Manipulative Why? (2022-23)

THIS RESEARCH

AIMS TO:

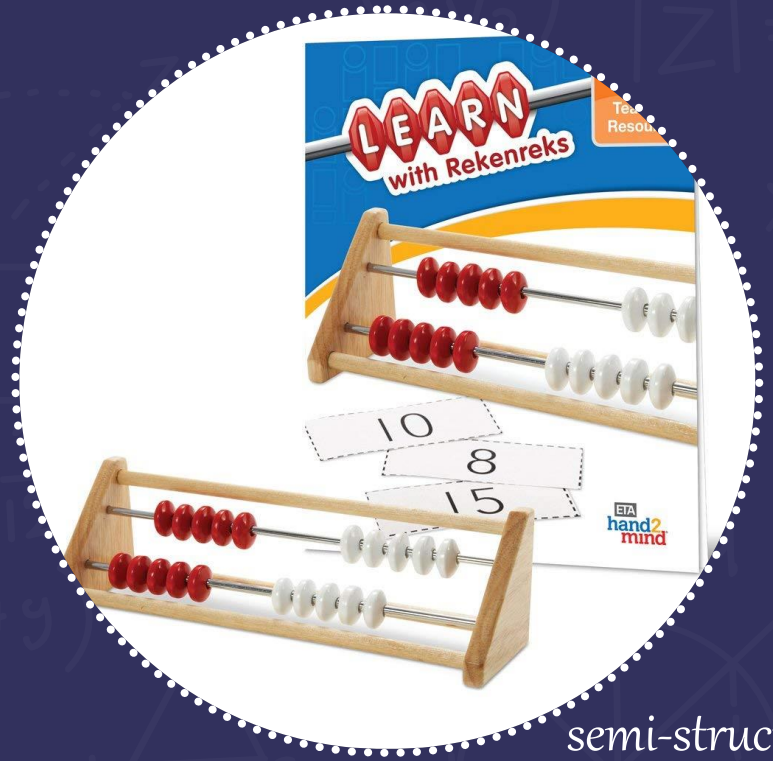
- document which manipulatives are used in primary classrooms
- record teachers' rationale for their selection and deployment
- establish the extent to which these decisions are informed by pedagogical content knowledge

IS IMPORTANT BECAUSE:

- The Education Endowment Foundation states that "practitioners' understanding of mathematical concepts needs to be strong in order to use manipulatives and representations effectively" (EEF, 2020, p.21)
- Whilst the Nuffield Report found that "teachers' choice of manipulatives was subject to disparate factors rather than pedagogical principles" (Griffiths, Back & Gifford, 2017)

METHODOLOGY

wide distribution to Maths Hub membership



single, critical case study approach

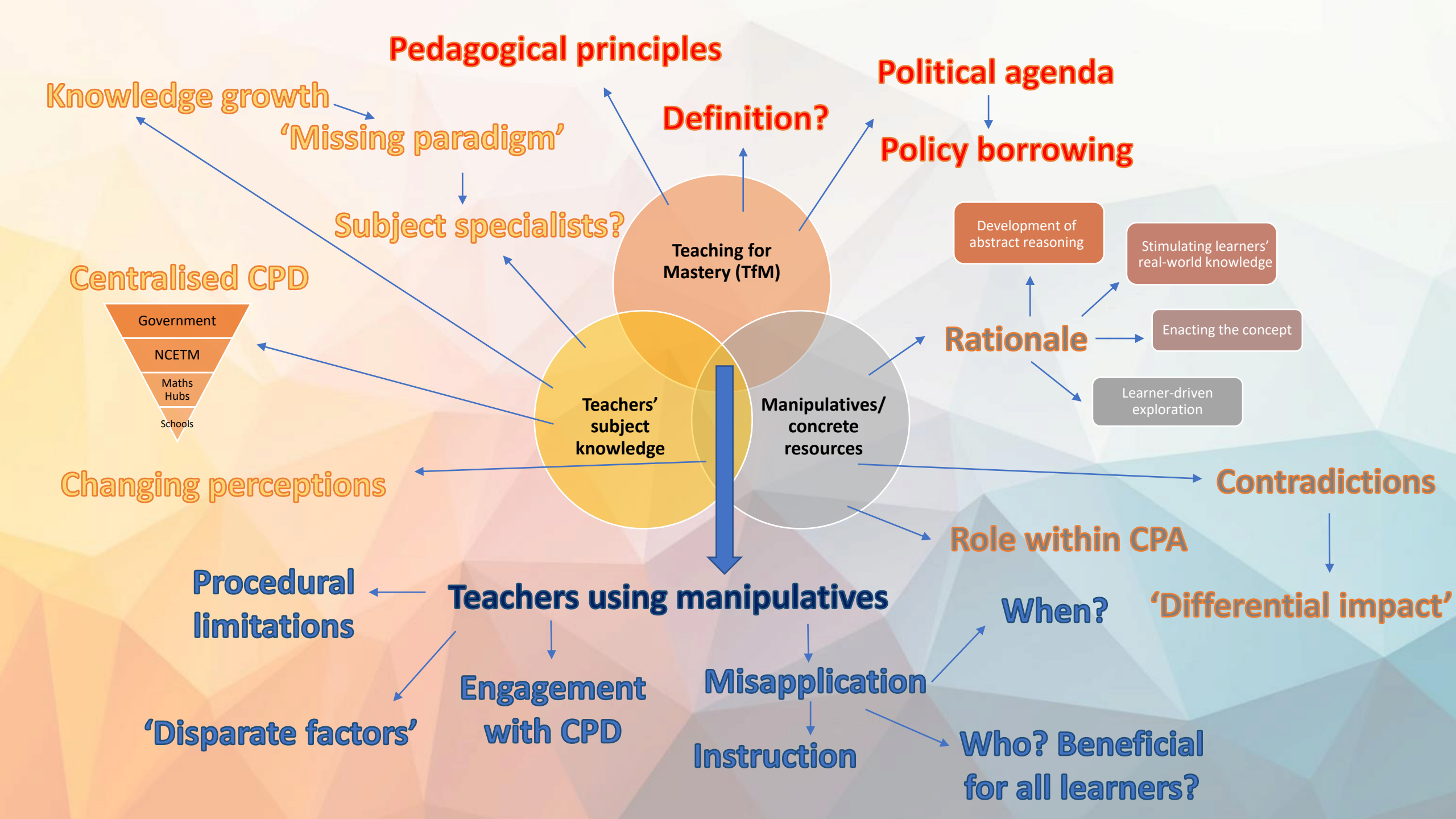
Case study

questionnaire	observations	document analysis
interviews		

semi-structured; explore questionnaire responses in detail

non-participant; validate that the planned use of manipulatives reflects classroom practice

lesson planning; each use of manipulatives is mapped to the relevant curriculum objective(s)


Pedagogical principles
Knowledge growth
'Missing paradigm'
Definition?
Political agenda
Policy borrowing
Subject specialists?
Teaching for Mastery (TfM)
Development of abstract reasoning
Stimulating learners' real-world knowledge
Centralised CPD
Government
NCETM
Maths Hubs
Schools
Rationale
Enacting the concept
Learner-driven exploration
Teachers' subject knowledge
Manipulatives/ concrete resources
Changing perceptions
Contradictions
Role within CPA
Procedural limitations
Teachers using manipulatives
When?
'Differential impact'
Misapplication
Engagement with CPD
'Disparate factors'
Instruction
Who? Beneficial for all learners?

WHAT AM I FINDING?

POLITICAL LANDSCAPE

The ever-changing government agenda heavily influences the messages and CPD delivered by the Maths Hub and teacher rhetoric

VARIATION

Content Knowledge (CK) and Pedagogical Content Knowledge (PCK) is hugely variable, even within individual schools

PRACTICALITY BEFORE PEDAGOGY?

Manipulatives seem to be valued by their practicality, e.g. versatility, rather than their pedagogical merit for a certain task

more research is needed to inform teachers' choices about which, and how many, representations to use and when (EEF, 2017, p.11)

Practicality vs. Pedagogy

AVAILABILITY

What is available in my classroom? Are there sufficient sets for the groups/class? Is it cheap or expensive?

VERSATILITY

Can this manipulative be used for multiple applications? Or is it topic/task specific?

LOGISTICS

Is it 'easy' to administer and oversee?

Is it explained in the scheme of work?

CONTENT KNOWLEDGE

Do I understand how to use this manipulative?

PEDAGOGICAL CONTENT KNOWLEDGE

Am I confident instructing others how to use this manipulative for this task?

KNOWLEDGE CREATION

Is the manipulative driving the task?

Is the task driving the manipulative?

The literature tells us:

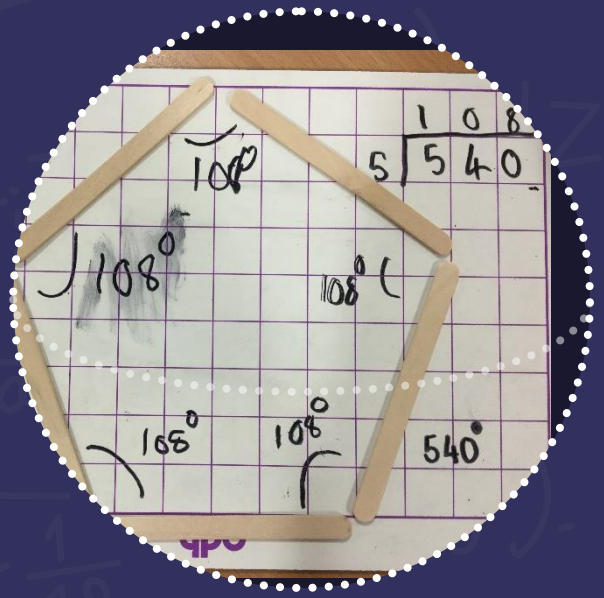
PEDAGOGICAL CONSIDERATIONS:

- a clear rationale for manipulative use in the context of the mathematical content being delivered
- the appropriate level of guidance is provided
- allow sufficient time
- the perceptual richness or blandness of the manipulative is considered
- manipulative use is linked to the abstract ideas being represented

PRACTICAL CONSIDERATIONS:

- practical organisation, including the amount of time given

Why is it important?



COLLABORATION

Sharing best practice with the many, not the few

CREATIVITY

Teaching mathematics in a way that inspires children

CONSISTENCY

Ensuring each child gets the same opportunities to enjoy mathematics

Your thoughts, opinions & questions

What does *maths mastery* look like in UK schools currently?

What are the opportunities and threats?

Do you use manipulatives as part of your practice?

Do you have preferred or more commonly-used manipulatives?

Have you delivered or attended CPD that involved manipulatives?

Was the selection/choice of manipulatives discussed?

Thank you

Simon Sheard

simon.sheard@sunderland.ac.uk

@sheard_simon

References

Boylan, M. (2019) 'Remastering mathematics: Mastery, remixes and mash ups', Association of Teachers of Mathematics

Carbonneau, K.J., Marley, S.C. and Selig, J.P. (2013). A meta-analysis of the efficacy of teaching mathematics with concrete manipulatives. Journal of Educational Psychology, 105(2), pp.380–400.

Clapham, A. and Vickers, R. (2018) 'Neither a borrower nor a lender be: exploring "teaching for mastery" policy borrowing', Oxford Review of Education, 44(6), pp. 787–805.

Duckworth, L. et al. (2015) 'Maths Hub, mastery and messy research', Proceedings of the British Society for Research into Learning Mathematics, 35(3).

Education Endowment Foundation (2017) Improving Mathematics in Key Stages Two and Three: guidance report.

Education Endowment Foundation (2020) Improving Mathematics in the Early Years and Key Stage 1: guidance report, Education Endowment Foundation. Education Endowment Foundation.

Garry, T. (2020) Mastery in Primary Mathematics. Bloomsbury.

Golafshani, N. (2013) 'Teachers' Beliefs and Teaching Mathematics with Manipulatives', Canadian Journal of Education, 36(3), pp. 137–159.

Griffiths, R., Black, J. and Gifford, S. (2017) Using manipulatives in the foundations of arithmetic: main report. University of Leicester.

Jerrim, J. and Vignoles, A. (2016) 'The link between East Asian "mastery" teaching methods and English children's mathematics skills', Economics of Education Review, 15(5), pp. 29–44.

NAMA (2015) Five Myths of Mastery in Mathematics. Available at: https://www.nama.org.uk/Downloads/Five%20Myths%20about%20Mathematics%20Mastery.pdf.