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‘ It’s to do with the teaching’: Developing an inclusive pedagogy through teacher professional development in children’s mathematical thinking

EARLI SIG 15

Special Educational Needs

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The studies

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Both studies

Involved professional development activity with a teachers in children's mathematical thinking - Cognitively Guided Instruction (CGI)

Study 1

- in primary special schools for children with moderate learning difficulties (12 teachers)

Study 2

- in Scottish mainstream primary (elementary) schools (21 teachers)
  - Funded by the Esmée Fairbairn Foundation under the New Approaches to Learning strand. Grant Ref. No. 08-3662

Aims - Both studies

- Following this professional development to explore the nature of teachers' learning in terms of knowledge and beliefs and how these translate into practice

Findings:

- Issues of teachers' knowledge of children's mathematical thinking and perceptions of expertise
- Knowledge of children's thinking is a powerful instructional pointer and this specific understanding of children's conceptualisations can facilitate an informed instructional response
- Special school teachers (8) had underestimated children's ability and understanding; all teachers (12) felt they had a better knowledge of children's mathematical thinking
- Mainstream teachers generally felt they lacked expertise to support struggling learners, following intervention most (20) felt better placed to support all learners.

Argument

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An inclusive pedagogy involves a dynamic response to the individual that is based on developing an understanding of the learner's conceptualisations.

This knowledge is then used to inform teaching.

This interactionist response differs from reductionist and remedial models of support that focus on identifying and responding to difference mechanistically.

Background

Issue of distinct pedagogy for children who struggle in their learning and the type of response required at the level of the individual (Florian, 2007; Thomas & Loxley, 2007; Lewis & Norwich, 2005)

If teachers have a deeper understanding of children's thinking they are better placed to support all learners.

Knowledge of children's thinking and development of pedagogical content knowledge (Shulman, 1986)

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Acquisition of strategies and techniques

Developing an inclusive pedagogy in mathematics teaching in primary classrooms demands an understanding of what sense learners are making as they engage in mathematical activity.

- This is about what all children do
- Challenges notion of 'expertise' required for working with particular learners – the nature of this expertise and where it resides
- The nature and quality of this engagement is crucially linked to teachers' knowledge and beliefs (Fennema et al. 1996)

Previous research - children with learning difficulties were able to build mathematical understanding through engaging in arithmetical word problems (Moscardini, 2010; Behrend, 2003, 1994; Empson, 2003)

Pedagogical content knowledge

Teacher learning through professional development

Teacher learning through interaction

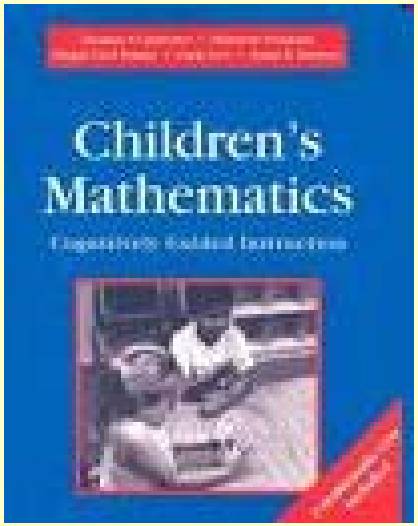
Teacher's own mathematical knowledge

Teacher's knowledge of how to structure learning opportunities

Teacher's knowledge of children's mathematical thinking

(Shulman, 1986)

Cognitively Guided Instruction



- Research-based professional development programme based on nearly 30 years research- University of Wisconsin, Madison
- Focuses on development of children's mathematical thinking
- Instructional decisions are informed by teachers' knowledge of children's thinking
- Problem solving is used as a context for children to reveal their thinking and to explore and develop a deeper understanding of mathematical concepts
- Most children come to school with considerable informal mathematical knowledge
- Connecting informal to more formal mathematical understanding
- Not a prescriptive pedagogy

CGI – Professional Development

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- Understanding of problem types (word problems)
- Understanding of children's solution strategies
- Using knowledge of children's mathematical thinking to inform teaching

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Joining problem

Design

Phase 1: Pre-intervention Aim: *determining teachers' existing knowledge base and current practice*
Initial semi-structured interviews; analysis of current planning and assessment.

Phase 2: Intervention Aim: *professional development in CGI with participants, followed by implementation*
CGI development – 2 days, applied in practice -12 weeks implementation.

Phase 3: Post-intervention Aim: *to determine effects of professional development undertaken by teachers, changes in knowledge and beliefs and impact on practice*
Post-intervention interviews, classroom observations, fieldnotes, research journals, hardcopy, video, photographic data

Phase 1: Findings

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In the special schools teachers

- were generally confident in supporting struggling learners, because of level of mathematics
- lack of knowledge of children's strategies, had difficulty in explaining what children did (3+6)
- a few teachers believed learning with understanding was not a viable proposition
- some teachers based teaching decisions on instinct, 'gut feeling', 'you just know the child', resources
- IEPs driven by curricular frameworks
- almost without exception, teachers believed in the importance of numeracy for real-life situations
- real-life situations were not used as a context for learning
- several teachers believed that procedural competency needed to be in place first to facilitate transfer
- no mention of problem-solving/ investigation as a pedagogy for learning with understanding
- dominant view of the teachers' own role was as an imparter of knowledge; when the term 'facilitator' was used this did not reflect a constructivist philosophy
- Teaching orientation was transmission, no evidence of 'connectionism' (Askew et al., 1997)

Phase 1: Findings

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In mainstream schools

- Almost no continuing professional development in numeracy
- Most teachers felt confident in their subject knowledge
- Generally lacked confidence in supporting struggling learners, lacked 'expertise'
- Struggling learners identified by failure
- Supported struggling learners on basis of staffing/ location/ repetition
  - 'I may take them to another corner of the classroom'
    ' some extra time with my PSA (pupil support assistant) to try and reinforce'
    'I would go and sit with them and go over things again because they might need to hear it all again'
  - ' We do a lot of collaborative learning… so if one person in the group knows how to get the answer sorry then the other children should know how to get it'
- Fragmented knowledge of children's mathematical thinking, difficulty in explaining what it is children do (3+6) (two teachers (P1 & P2) described a count all strategy) - following the interview teachers expressed an interest in learning more about children's mathematical thinking
- Difficult to ensure understanding with children who struggle and expressed a need for new and more adequate teaching strategies
- Teaching informed by external planning frameworks, for children who struggle focus was on pace and content

Phase 1

Teachers in both sectors

- Almost no continuing professional development in numeracy
- Difficulty in explaining what it is children do (3+6)
- Mainstream teachers gave a sense that they lacked ‘expertise’ for working with struggling learners
- Teachers in special schools generally felt confident in supporting children who struggled in their learning
- In both sectors, teachers had fragmented knowledge of children’s mathematical thinking
- Following the interview teachers in both sectors expressed an interest in learning more about children’s mathematical thinking

Phases 2 & 3: Findings

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- Teachers developed CGI activities in their classrooms in a wide variety of ways (observed sessions confirmed teachers' fieldnotes)
- Teachers quickly became familiar with problem types
- Recognising children's strategies far more challenging
- Most teachers worked with whole class; when working with groups teacher tended to work with lowest ability groups (mainstream)
- Emphasising the importance of accessing children's thinking; strong focus on pupil explanation from all teachers (mainstream)
- More detailed and focussed recording of what children were doing – focussing on process
- Extent of data gathering and record keeping by several teachers far exceeded what was requested
- Some teachers worked beyond content of material covered in development days (mainstream)

Teacher Learning

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- Evidence that teachers were beginning to focus on ‘what’ children’s understanding was, rather than ‘whether’

- This was beginning to inform practice but also challenging – ‘what do I do now?’

‘I am probably drowning in my thoughts about it because it has been a real eye-opener…it has made it more complicated for me now that I am aware that there is so many… difficulties’
(P3/4 teacher, mainstream)

- Teachers’ recognition of the potential to use knowledge of children’s mathematical thinking

- This was recognised for ALL learners

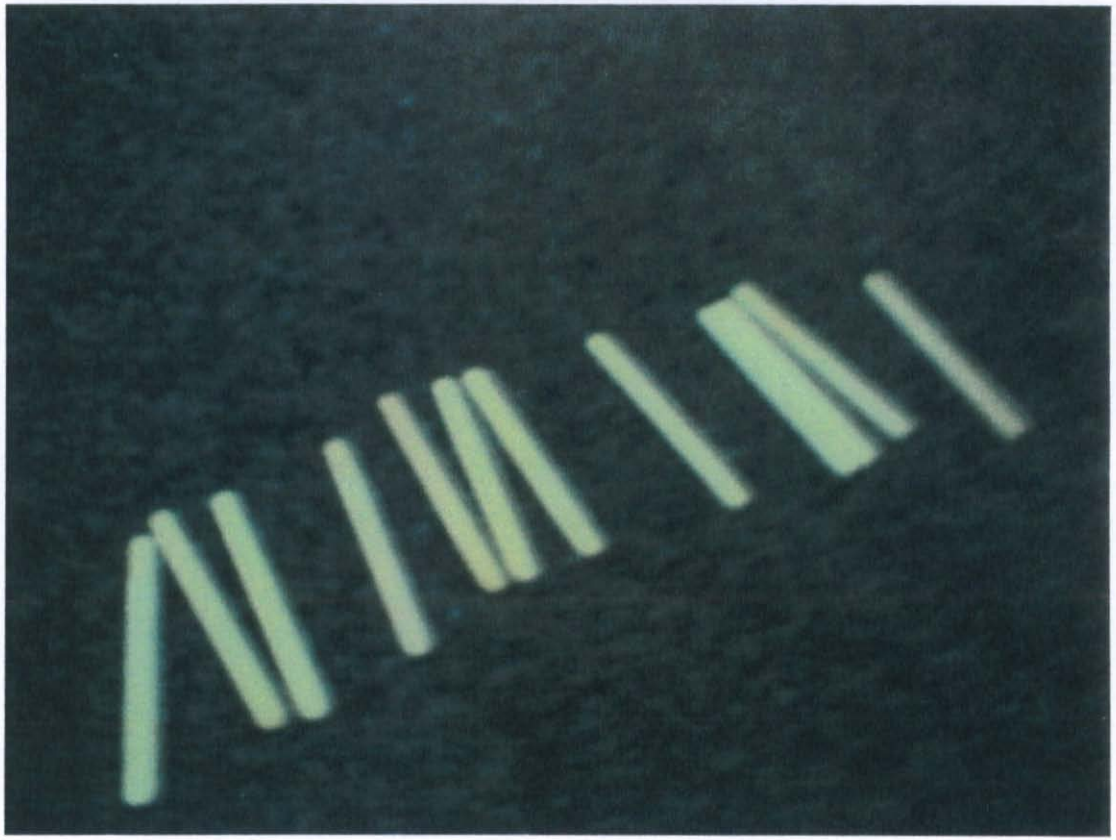
Example of teacher feedback after Day 1

‘ I gave a group the following question.

Melons are packed in a box. There are three layers. In each layer there are three rows of four melons. How many melons are there in the box?

[in problem solving activities] children usually work with a number partner so it is difficult to know who has solved the problem.

We spent longer than usual getting each child to explain to the others how they got their answers.’



This example was really interesting . This pupil has learning difficulties and I thought he had it wrong but when he explained his reasoning he was right. Three of the sticks represented the layers. He only had three sticks in between each layer but said that each sticks represented 4 melons. He then added 4+4+4+4……. Until he reached 36.
This did not really surprise me as I often find that dyslexic children think in a different way and learn in a different way. We don't teach the way they learn??????

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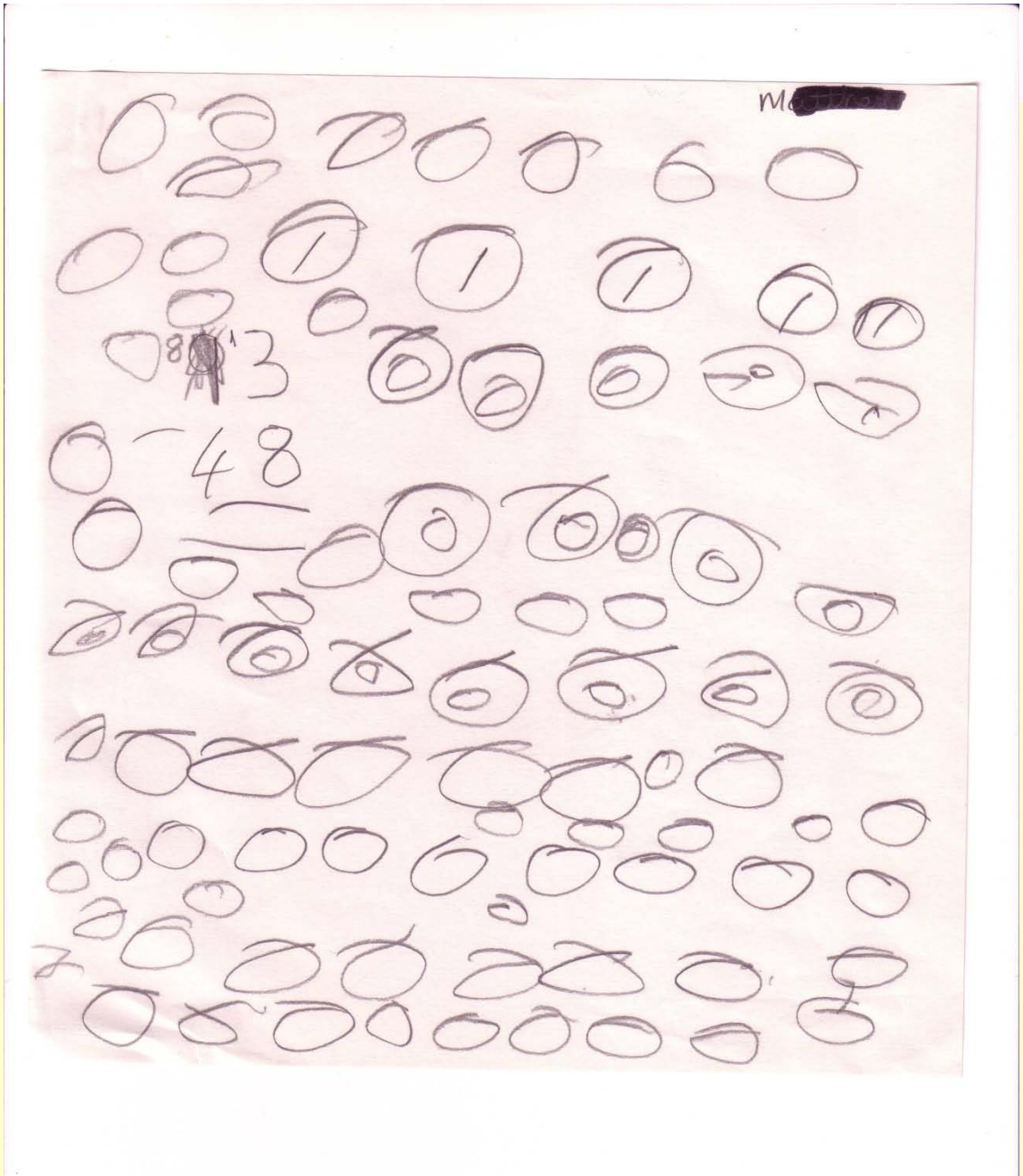
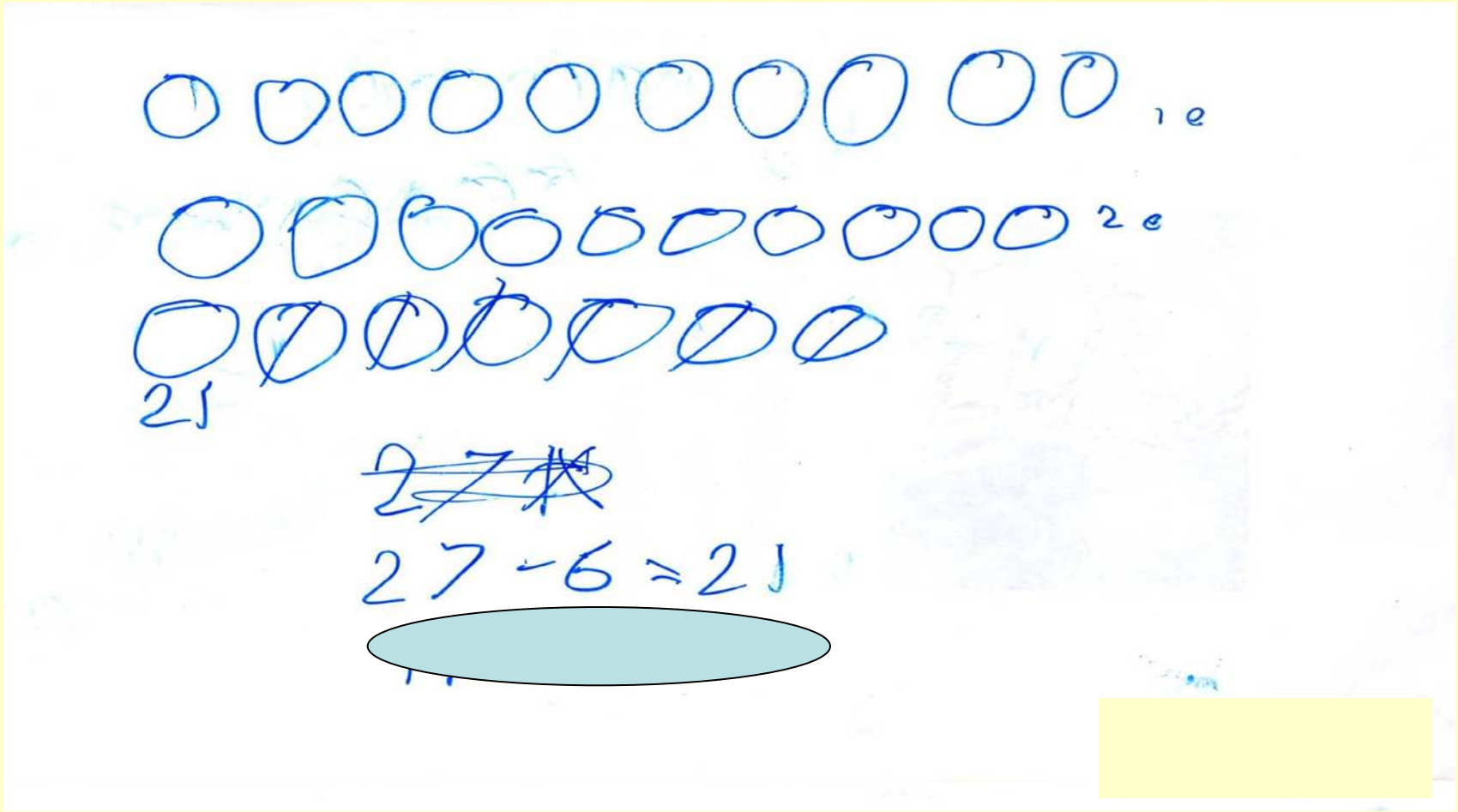
Veruca Salt comes from a very rich family. She has 93 dolls! 48 of her dolls have blonde hair. How many do not?




1e
2e
21
27
27-6=21

Final interviews

‘I thought it was a piece of nonsense, I really did and I must admit I didn’t think it would work…..It has been quite an eye-opener for me I must admit….I can teach them and they can learn it but they might not understand it. I never gave that a second thought before, quite honestly. If they could do it I was quite happy. I’m not now.’
P5 Teacher, special school

‘I am starting to know a lot more, a lot more than I had before …as I said before, I didn’t really understand a lot of what was going on… I actually lost the kids and I couldn’t see what they were doing.’
P 7 Teacher, special school

‘with this I learned so much more about what they could actually do than you could from a National Assessment’
P3/4 Teacher, mainstream

‘Much better placed to support all learners…I now have a better understanding of how children think… If I’m in P7 next year and have a child working towards Level A … I’m definitely more equipped to support them’
P7 Teacher, mainstream

‘What I’d say now is that it is not a case of struggling, it is a case of not being treated in a way that you can’t access it because what I think is that I don’t have kids who aren’t mainstream kids… children who are struggling just can’t do it in the way that is presented to them in the textbook… before I would have said you just don’t get it… It is to do with the teaching’.
P6 Teacher , mainstream

Teachers' perceptions of children's ability challenged

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'The wee girl who I would have said if you like was the best in the group …she was the one who struggled with this the most. The ones who were less able in my eyes got on.'
P 4 Teacher, mainstream

' I think the thing I liked most of all was that the children who were not achieving when they started this, because it was my less able group, are now looking forward to problem solving and saying 'when are we doing it … they are dying to do it because they are all succeeding and that has made a huge difference to them because a lot of these kids were just not succeeding in anything really.'
P 4 Teacher, mainstream

Emerging themes

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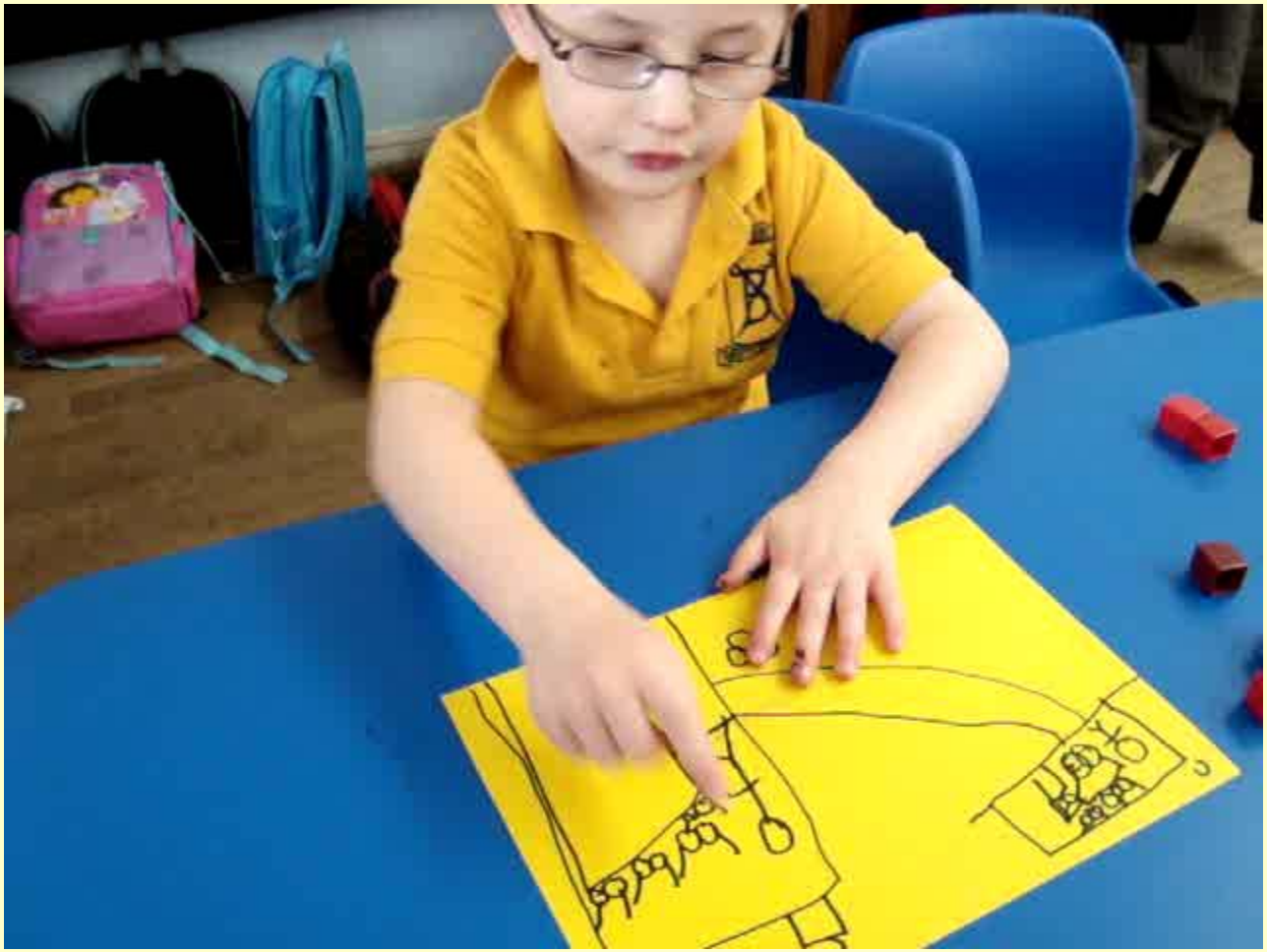
- CGI as a powerful means of conceptualising children's mathematical learning
  - this was not seen as separate or different

- Usefulness of framework for analysis and reflection
  - Teachers' awareness of what it is that **they** do

- Learning to use knowledge of children's thinking to inform teaching
  - focussing on learning rather than technique of teaching
  - deeper knowledge of children's mathematical thinking supported an individual response

- Issue of sustainable professional development
  - learning situated in practice
  - implications for organisation and structure

Cameron’s glasses



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