Lesson study structured by a discursive resource: benefits and constraints

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Seminar presentation: Leeds University, UK
17 November 2016

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Lesson study (in maths education)

- Widespread – across country contexts – different
- In focus at ICME13 – across strands
- Books, special issues ....

Across curriculum

- WALLS annual conference; IJLLS – dedicated journal (not only mathematics)
- Extension into ITE (e.g. Norway)

1. Japan and China - Job embedded, and so part of professional practice – long standing and system wide – influential

    - Japan – research lessons, repetition not required, focused question about learning/teaching (USA; UK; Norway; Philippines; Malasia; also through JICA in Africa)

    - China – deliberate practice, public lessons, repetition and crafting of skills/practices and lessons, content and strategy focus, variation (Sweden/Hong Kong)

Common elements

- Professional learning Community (teachers, experienced or knowledgeable ‘others’)

- Joint lesson planning, teaching, reflection

Differences/adaptations

- Job embedded
- Teacher driven/externally initiated 'PD'
- Lesson revision and repetition
- Role of experienced 'other',
- (Research) focus
- Theoretical resources.

South African (maths) education context

1. Poverty and educational outcomes - dual economy of schooling

What is made available to learn, **for whom**, and ***not just how*** is critical for an equity/social justice agenda
And so the agenda for the Wits Maths Connect Project

2. ‘Failure’ of educational ‘aid’ interventions

- From ‘traditional’ (ritualised) pedagogy to learner centered (inquiry based) practices in developing country contexts; paradigm ‘clashes’ (Tabulawa, R. – Botwsana – “tissue rejection”)

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Improving the teaching and learning of mathematics in secondary schools in one province in SA, through linked research and professional development of mathematics teachers

Improving teachers MfT

Improving teaching

Impacting learning Learner gains

Mathematical discourse in instruction - MDI

A sociocultural framework for studying and working on mathematics teaching

Mathematics for teaching course

Lesson study

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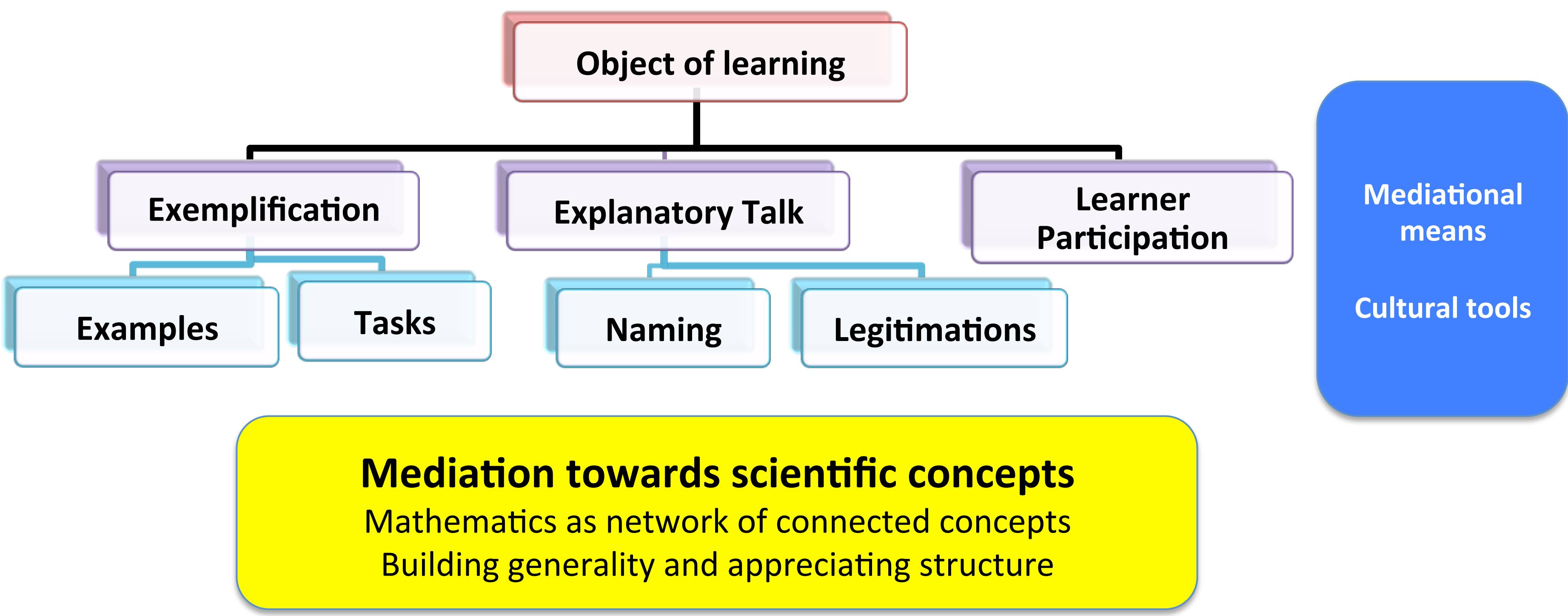
The framework

Mathematical discourse in instruction (MDI):

A socio-cultural framework for describing and studying/ working on mathematics teaching



WMCS Mathematics Teaching Framework

Structuring resource guiding planning and reflection

Mediated in the MfT course, and then used in follow on LS

Lesson goal		
Exemplification Examples, tasks and representations	**Learner Participation** Doing maths and talking maths	**Explanatory communication** Word use and justifications

LS Research Questions

1. What changes in instructional quality (MDI; CHAT)

2. **What opportunities for learning** for mathematics teachers and researchers
   - with respect to mathematics (concepts, practices)
   - teaching mathematics and (examples, tasks and representations, learner thinking, language issues)
   - doing lesson study (facilitation, social relations, community 'rules/ norms')

Critical incidents identified by focal points of reflective discussion, provoked by tensions/dilemmas, and seem related to elements of framework

Chinese framework: important knowledge point, difficult point and critical point)

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Cluster 1, Cycle 1, May 2016

- 4 teachers, 3 WMCS staff.
- Grade 10, 2 schools in Johannesburg.
- Topic: "simplifying algebraic expressions with brackets in different positions"
- 3 meetings (video records):
  - Planning for teaching – joint plan 1
  - Teaching 1 and reflection - joint plan 2
  - (Re-)Teaching 2 and final reflection
- Transcription, identification of Critical Incidents, construction of data and analysis ....

Joint plan

Lesson goal: Learners can simplify expressions with brackets when these are in different positions.

Exemplification

Examples, tasks and representations

Pre-test assessment

Introduction/Introducing the lesson: Calculate the following:

a)	$4+3(4+5)=$	
b)	$(4+3)4+5=$	
c)	$(4+3)(4+5)=$	

Activity 1: Simplify the following

$x+3(x+5)=$	The board might look like this	$4+3(4+5)=$
$(x+3)x+5=$		$(4+3)4+5=$

Activity 2: Simplify

$(x+3)(x+5)=$

$(x+3)+(x+5)=$

Activity 3: Simplify

a) $(x-3x)+5=$
b) $(x-3)x+5=$
c) $x(-3x+5)=$
d) $x-(3x+5)=$

Activity 4: Simplify

a) $x-8(x+6)=$
b) $(x-8)x+6=$
c) $(x-3)(x+3)=$
d) $(x-3)-(x+3)=$

Activity 5 (Post-Test): Simplify

a) $2p-(4+p)=$
b) $2p\,(-4+p)=$

Learner Participation

Doing maths and talking maths

Write the assessment.

Introduction:

- Learners will work on question a, b & c on own.
- Class discussion re question a, b & c; and BOMDAS and Distributive law.
- Comparing

Activity 1 & 2: same as introduction

Activity 3: Teacher-led discussion: what changes/stays the same if I put brackets "here" ..

Activity 4: Work on own.

Activity 5: Write the assessment (individual).

Explanatory communication

Word use and justifications

Pre-test assessment

Introduction: The teachers will ask the learners to work individually: Calculate the following. here, the teacher will ask the learners not just to work on this using the addition only (or BEMDAS) but also the distributive law

That introductory activity will be left on the board and introduce Activity 1 with similar numbers and structure so that to compare the two activities.

Activity 1: (Individually or in pairs?) Simplify the following

Whole class discussion should happen after the learners try to solve the activity. The main focus is that we see the same numbers, same order and what changing is the brackets.

Activity 3: Simplify

Here the teachers will put brackets in different positions in $x-3x+5$ and then ask the learners about the answer as follows.

Activity 4: Simplify

Here the teacher should watch the time and decide how to take the four sub-problems (a-d) and to give more time to Activity 5 (post-test activity)

Activity 5 (Post-Test): Simplify

Teacher will watch the time! [Note: this is the same as the pre-test, for assessment purpose.]

Reflection Lesson 1

- Focal point for T1: "Sticking to the plan" in the face of learner error, albeit unsurprising; "too easy"
  - Dilemma of teaching in LS with joint plan …
- Replan with more demanding tasks

Lesson goal: Learners can simplify expressions with brackets when these are in different positions.

Lesson 1	Lesson 2
Activity 3: Simplify 1. $(x-3x)+5=$ 2. $(x-3)x+5=$ 3. $x(-3x+5)=$ 4. $x-(3x+5)=$	Activity 3: insert bracket(s) in the expressions on the left side so that the two sides are equal 1. $x - 3x + 5 = -3x^2 + 5x$ 2. $x - 3x + 5 = -2x - 5$ 3. $x - 3x + 5 = -x^2 - 3x + 5$

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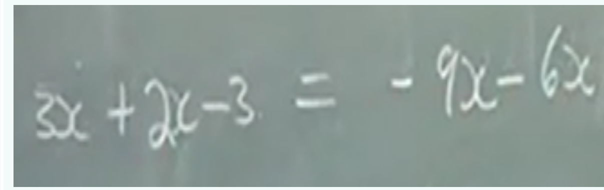
Critical Incident Activity 3: Unplanned example

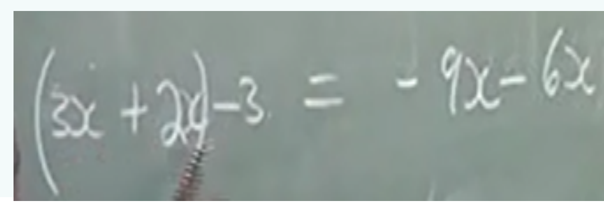
- Followed the joint plan and discussed errors
- When he introduced activity 3 as planned, learners started to complain, and so he offered an unplanned example, to exemplify what to do.

Excerpt from the discussion between T2 and learners after introducing activity 3

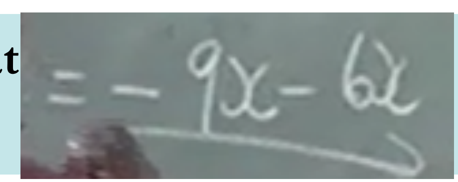
T2 **Then it's a good exercise, okay Let's look at this one,** *I just made that one for an example* **because some people are saying that this, it might be challenging. Now I've got this expression and I need to insert brackets along this expression (pointing to LHS) such that if I simplify the expression I will get this (RHS) as my final result.**



T2 **Now I look at it, so if I put a bracket here so I've got negative three out there, simplify this and tell me what do you get?**



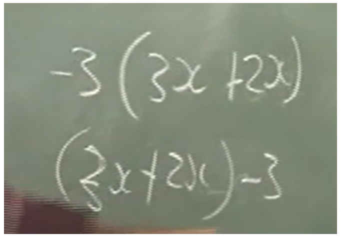
T2 **So can you see when I simplify this I get that**



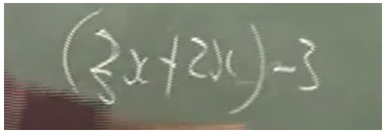
Reflection Lesson 2 …

T2 raised Activity 3 for discussion as he did not expect learners to have difficulty with the task, and insertion of unplanned example. R1 asked about his solution

T2: *… what I'm thinking is that they just want to, it's just to see that this is no longer minus three, it's negative three, this number is an integer so they usually get to working with numbers that if this is negative three and three x plus two x and negative three like that* [see the figure] *it may have been not easy for them to see that this is an integer.*



R1: If it had been plus three there (pointing to -3) what would you have done?



T2: It will still .. mean .. I'm going to multiply, it's like if it was … oh, okay, no!

Following discussion on whether this should have been dealt with during the lesson, T2 confidently said:

> *You know the problem? If you stand up and you disagree with me like face to face then that's when they will see there's a problem and now you've created an impression to them. But you don't make it as if you've seen, you make it as if you can't see, you're asking.*

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1. **Critical incidents – learning opportunities**

- Mathematics, mathematics teaching, doing LS

2. **Critical incidents – make visible**

- Role/skills of the 'experienced/knowledgeable other'
  - Offering suggestions for changing task
  - Facilitating discussion of teachers' mathematics 'error'
- Complex social relations when "mathematics goes wrong" and need for agreed 'rules' and 'roles'

Jaworski 2001,
co-learning partnership
Pedagogical power
Mathematics power
Educative power

Huang & Shimizu, 2016
Teacher learning and improving teaching through LS
Development of knowledgeable others

Lewis, 2016
Teachers as learners
Facilitators as learners

Doing and researching LS

- Benefits and constraints

  For learning

  - The value of selection and sequencing
  - The value of careful attention to word use
  - The workings of changing task demands
  - The ‘place’ of LS when ‘weak’ or institutionalised subject knowledge also at issue

  For research

  - Evidencing teacher learning, researcher learning
  - Ethics of selective reporting

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