Improving mathematics education in South Africa

The Wits Maths Connect Secondary (WMCS) project (2010-2014)

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University of the Witwatersrand
Access for all - learning for some


Can a research informed professional development intervention

* Shift this curve?

* Thicken pipeline within the secondary school?
Ten Schools on district

• 5 (becoming 6) no-fee (large)

• 5 low-fee (smaller)

• “under the radar”
  – Relatively functional – underperforming
Our intervention – the goal

• We set out to strengthen teachers’ relationship to mathematics, and through this shape their ‘discourse’, firstly in and for themselves, and then in their practice (PD)
  – Not only FET – Grade 9 – 10 critical transition point

• And then to be able describe whether and how this shifts over time, in what ways, and how this is related to what is made available to learn, and to learning gains (RESEARCH)
Our starting point on teaching

• Teaching has purpose – there is something to be learned ... **object of learning** (concept, procedure or algorithm, meta-mathematical/practice)

• bringing that into focus is central to the work of teaching

• Significance of ‘talk’ in mathematics classrooms

• Privilege “scientific” concepts
Our overarching focus – “big story”

Mathematical discourse in instruction (MDI)

• Exemplification, explanatory talk, learner participation

• Implicated in, but only a part of a set of practices and conditions that produce poor performance across our schools

• It matters deeply, how teachers’ mathematical discourse in instruction supports (or not) mathematical learning
PD model

Hidden in here – unintended ‘process and outcome’ – training the trainers
• Two ‘20 day courses’
  – Critical transitions
    » Transition Maths 1: Gr 9 – 10
    » Transition Maths 2: Gr 11/12 – tertiary education
  – Mathematics knowledge for teaching
  – Working on practice

• Reversioned learning/lesson study’ (MDI)
Key operating principles

• Participation as joint commitment and enterprise of the school, individual teachers and the project (and so the University).

• 20 days – 8 X 2 days at Wits (Release from school on 10 days; 6 days teacher’s time); 4 days equivalent support in school

• Time for teachers to work at their mathematics and teaching over time, and between sessions

• Resources for the school ... supporting ‘successful participation’ of the teachers (funds, technology).

• Potential for ‘spreading out’ - lean and so “cost effective”
In school learning/lesson study with a structuring framework (MTF)

- Studying teaching together (plan, teach ...)
- Using a discursive resource
  - Maths Teaching Framework (informed by MDI)
- Teachers teaching their own learners
- Other teachers observing
- 3-week block; 3 blocks in 2014; ‘curriculum’
- Clusters of schools
Important results

“the spine”
More learners are obtaining A, B and C-symbols in Grade 12 Mathematics. More careful selection of learners for Mathematics has substantially reduced the numbers scoring below 30%.
<table>
<thead>
<tr>
<th>Year</th>
<th>No. of A, B, C symbols</th>
<th>% A, B, C symbols</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>79</td>
<td>50</td>
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</table>

<table>
<thead>
<tr>
<th>NSC Maths Year</th>
<th>Tot writing Maths</th>
<th>Pass rate (&gt;=30%)</th>
<th>Pass rate (&gt;=40%)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>National</td>
<td>WMCS</td>
<td>National</td>
</tr>
<tr>
<td>2008</td>
<td>300 008</td>
<td>761</td>
<td>45.4</td>
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<tr>
<td>2009</td>
<td>290 630</td>
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<tr>
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<td>224 635</td>
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<td>2013</td>
<td>241 509</td>
<td>490</td>
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<td>2014</td>
<td>225 458</td>
<td>609</td>
<td>53.5</td>
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</table>
Moving away from NSC and closer to intervention
Learning gains

Investigating learning gains in relation to teachers’ participation in professional development courses

Intervention group and control group of teachers

Pre- and post-test with 800 Grade 10 learners in 5 project schools over 1 year

Learners taught by teachers who had completed a TM course made **bigger gains** than those taught by teachers who had not participated in a TM course. These learners had a **lower average pre-test score** than the control group but a **higher average post-test score**.

![Graph showing Learning Gains](attachment:image.png)
**Teachers’ learning - mathematics**

<table>
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<tr>
<th>Course, year</th>
<th>Registered</th>
<th>Completion</th>
<th>Success</th>
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<tbody>
<tr>
<td>TM 1 2012</td>
<td>21</td>
<td>18</td>
<td>10</td>
</tr>
<tr>
<td>TM 1 2013</td>
<td>15</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>TM 2 2012-13</td>
<td>15</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>TM 2 2014</td>
<td>21</td>
<td>16</td>
<td>8</td>
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</tbody>
</table>

- **Teacher’s MDI - pre and post video data TM1**
  - 60% TM1
  - 65% TM2

**Improvement**
- Selection and sequencing of examples
- Naming of signifiers

**No change**
- Nature of the tasks
- Reasoning by principle
# MDI: Summary

<table>
<thead>
<tr>
<th></th>
<th>Exemplification</th>
<th>Explanatory talk</th>
<th>Learner Participation</th>
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<tbody>
<tr>
<td></td>
<td>Examples</td>
<td>Tasks</td>
<td>Naming</td>
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<td>L3</td>
<td>L2-L1</td>
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Closing remarks

• Progress? Constraints? Contributions?
www.wits.ac.za/WitsMathsConnect

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Thank you