Improving mathematics education in South Africa

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

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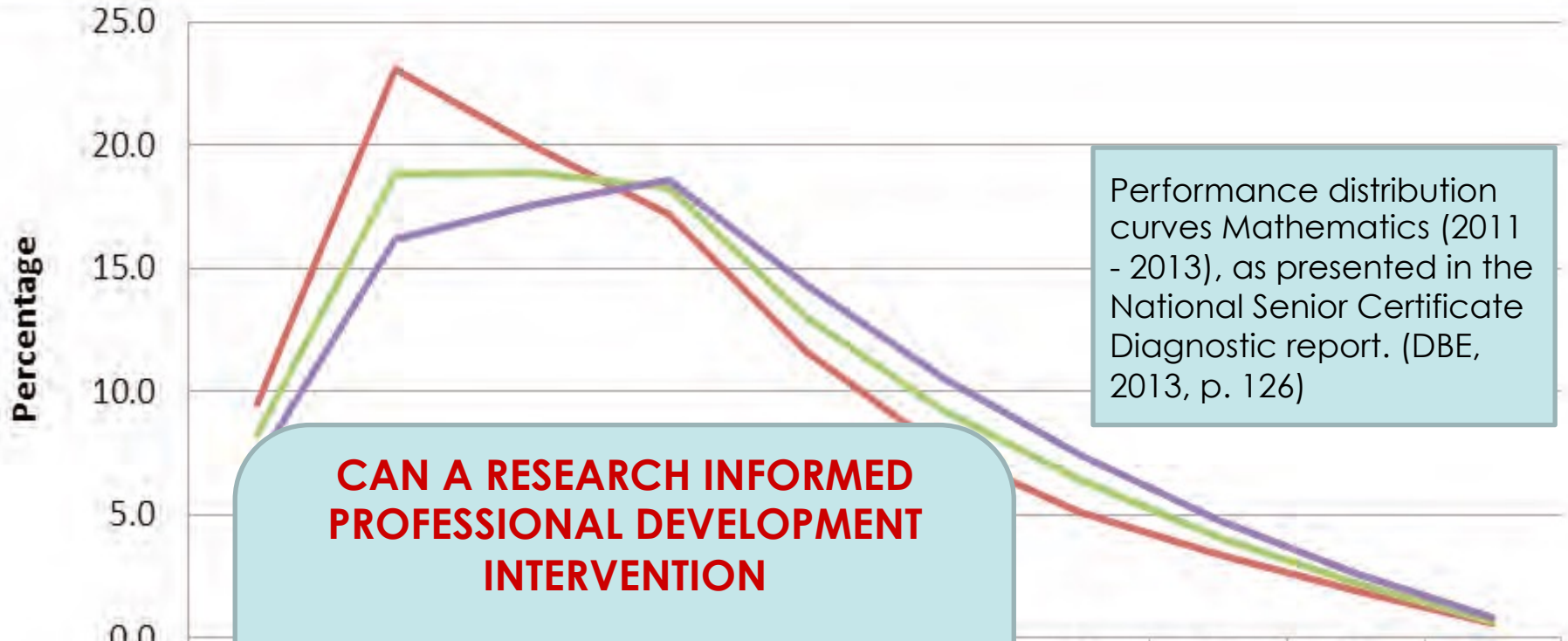
Professor Jill Adler
FRF Chair of Mathematics Education
and the WMCS project team
School of Education
University of the Witwatersrand

Access for all - learning for some



	0					60 - 69.9	70 - 79.9	80 - 89.9	90 - 100
2011						5.1	3.4	1.9	0.6
2012	8					6.4	4.1	2.2	0.7
2013	7.1	16.2	17.6	18.6	14.3	10.5	7.4	4.8	2.6	0.8

Performance distribution curves Mathematics (2011 - 2013), as presented in the National Senior Certificate Diagnostic report. (DBE, 2013, p. 126)

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

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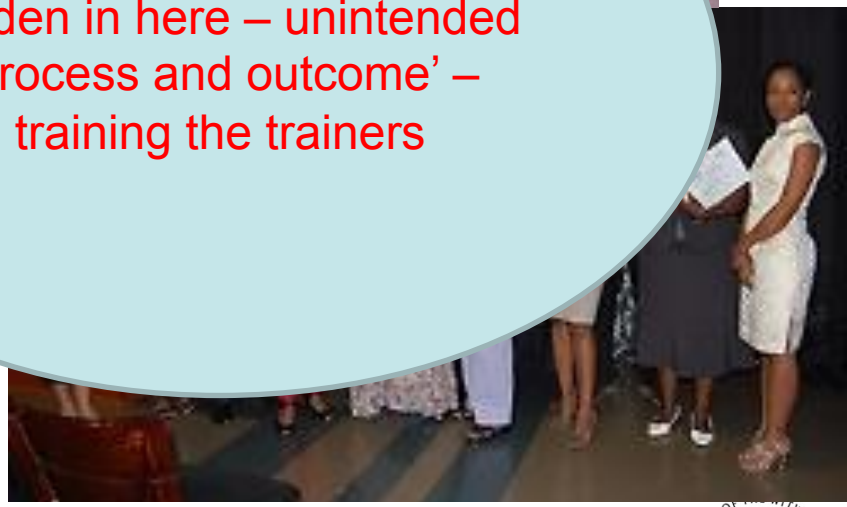
PD model



Hidden in here – unintended 'process and outcome' – training the trainers

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- **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)**

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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"

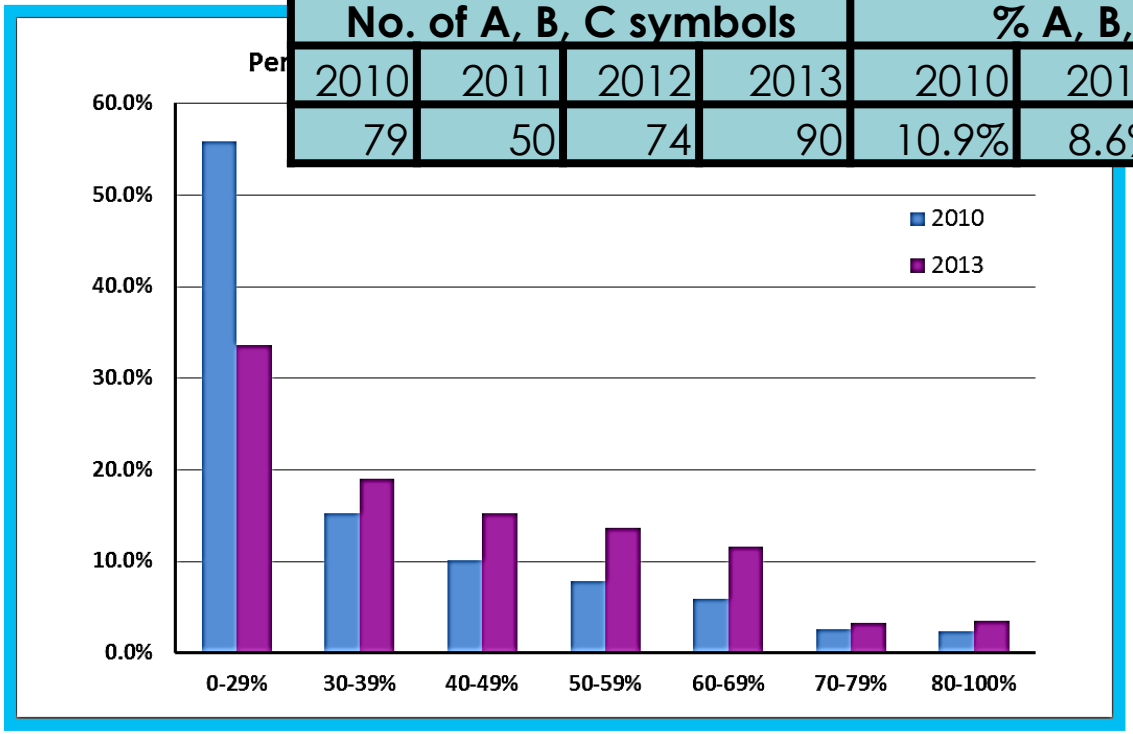
In school learning/lesson study with a structuring framework (MTF)

- 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

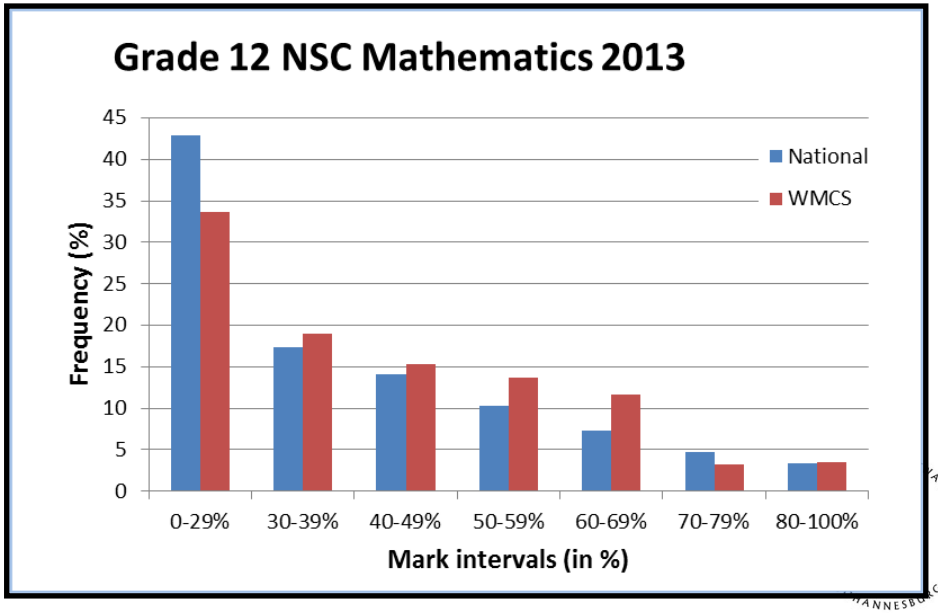
“the spine”

No. of A, B, C symbols				% A, B, C symbols			
2010	2011	2012	2013	2010	2011	2012	2013
79	50	74	90	10.9%	8.6%	13.3%	18.4%



NSC results Shifting the curve

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%.



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2014
60

2014
10%

No. of A, B, C symbols				% A, B, C symbols			
2010	2011	2012	2013	2010	2011	2012	2013
79	50	74	90	10.9%	8.6%	13.3%	18.4%

NSC Maths Year	Tot writing Maths		Pass rate (>=30%)		Pass rate (>=40%)	
	National	WMCS	National	WMCS	National	WMCS
2008	300 008	761	45.4	50.9	29.9	32.5
2009	290 630	703	46.0	46.2	29.4	27.0
2010	263 034	727	47.4	44.2	30.9	28.9
2011	224 635	581	46.3	46	30.1	29.3
2012	225 874	556	54.0	58.8	35.7	37.2
2013	241 509	490	59.1	66.3	40.5	47.3
2014	225 458	609	53.5	47.9	35.1	29.7

Moving away from NSC and closer to intervention

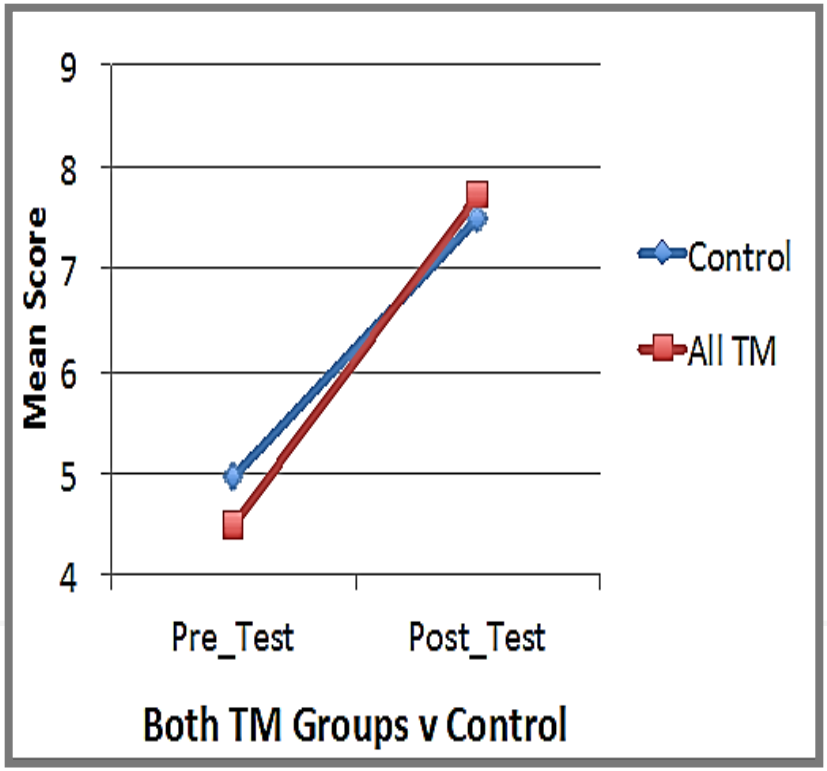
Learning gains

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.**



Teachers' learning - mathematics

Course, year	Registered	Completion	Success
TM 1 2012	21	18	10
TM 1 2013	15	10	9
TM 2 2012-13	15	11	9
TM 2 2014	21	16	8

- 60% TM1
- 65% TM2

Teachers' MDI - pre and post video data TM1

Improvement

- Selection and sequencing of examples
- Naming of signifiers

No change

- Nature of the tasks
- Reasoning by principle

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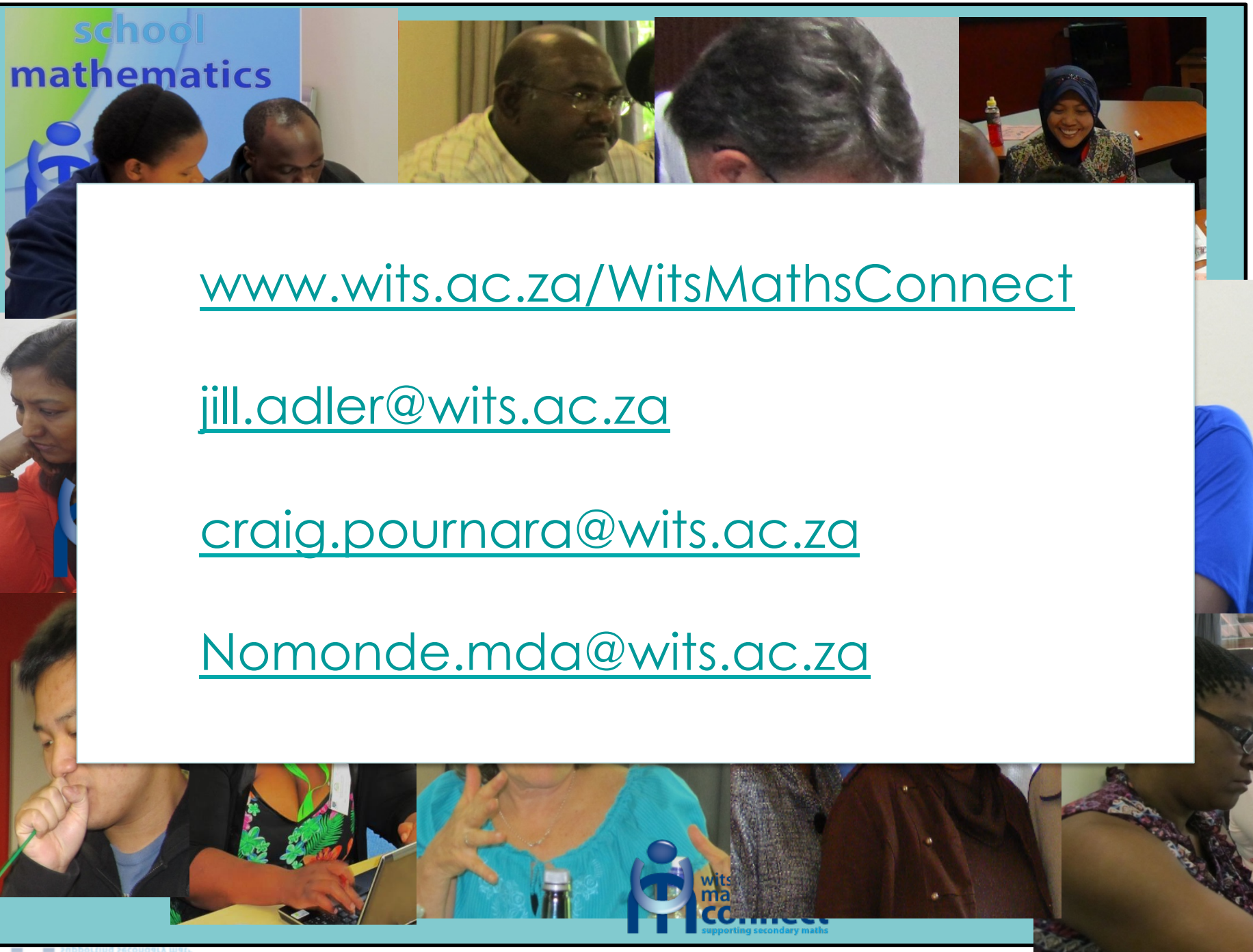
MDI: Summary

	Exemplification				Explanatory talk				Learner Participation	
	Examples		Tasks		Naming		Legitimation			
	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013
T1	L1	L3	L2-L1	L2-L1	L2	L4	L1	L2	L1	L1
T2	L3	L3	L2	L1	L2	L2	L1	L3	L1	L2
T3	L3	L3	L2-L1	L2-L1	L3	L2	L3	L3	L2	L1*
T4	L1	L3	L1	L2-L1	L1	L3	L2	L2	L1	L2
T5	L1	L3	L2-L1	L3	L3	L4	L2	L3	L2	L3

Closing remarks

- Progress? Constraints? Contributions?



www.wits.ac.za/WitsMathsConnect

jill.adler@wits.ac.za

craig.pournara@wits.ac.za

Nomonde.mda@wits.ac.za

Thank you