

# Pre-service Mathematics Teachers' Concerns and Beliefs on Implementing Curriculum Reform

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# Pre-service Post-Graduate Post-primary Mathematics Teachers – Longitudinal Study

1. What are the concerns of Irish pre-service teachers of Mathematics relative to the revised curriculum, at the beginning of their initial teacher education?
2. How efficacious do they feel implementing this reform as pre-service teachers?
3. (How do these concerns evolve over their initial teacher education and as newly-qualified teachers?)
4. How do their attitudes towards mathematics relate to their concerns and sense of efficacy?)

# Reform of the Post-Primary Mathematics Curriculum in Ireland – ‘Project Maths’

Increased emphasis on *problem-solving*, a focus on ‘*sense-making*’, and an emphasis on the role of the *teacher as a facilitator* of student learning

Change in approaches to teaching and learning of Mathematics from ‘traditional’ classroom practices (Lyons et al., 2003) to more constructivist approaches to teaching and learning (Lyons et al., 2003)

Benefits of new maths syllabus questioned  
Irish Independent, Aug 07, 2013

Project Maths doesn't quite add up  
Irish Examiner, Aug 14, 2013

Students chasing honours maths bonus risk being out of their depth  
Irish Independent, April 2016

Project Maths not to blame for declining results in third-level maths, experts clarify  
Silicon Republic June 2015

# Teachers' Fundamental Role in Curriculum Reform

- Implementation of reform-based curriculum often requires a transformation in teachers' ideas about and understanding of teaching and learning of a subject (Roehrig & Kruse, 2005)
- Reform may be resisted if teachers feel daunted or challenged in why they should change their practice (Fetters et al., 2002)
- Changes in teachers' practices do not occur by providing innovative materials but by addressing their concerns relative to their pedagogical understandings (Manouchehri and Goodman, 2000)
- “fragile and transient” reform (Senger 1999)
- Useful for policy makers and educators to have a picture of teachers' concerns before and during the implementation of a reform (Fullan, 1999)

# Curriculum Reform and Teacher Concerns

Concerns: feelings, thoughts, and reactions individuals develop in regard to a new programme or innovation which is relevant to their daily job (Hord et al., 1998)

Teachers tend to focus on self-concerns at the beginning of the implementation process (Christou et al., 2004)

Teachers' concerns evolve as they engage with reform (van den Berg et al., 2000)

The success of a reform depends on teachers moving from self concerns to impact concerns (McKinney et al., 1999)

# Methodology

42 pre-service teachers in four national universities in 1<sup>st</sup> year of their initial teacher education (Professional Master of Education)

Qualitative and quantitative data:

- Open responses to the curriculum reform
- Concerns & efficacy questions (Charalambos & Philippou, 2010)
- Attitudes towards mathematics (Fennema & Sherman, 1976)
- Content knowledge as relevant to the curriculum reform

(Ní Ríordáin et al., in publication)

- Focus group interviews

- Observation and reflection of practice

Phase 1

Phase 2

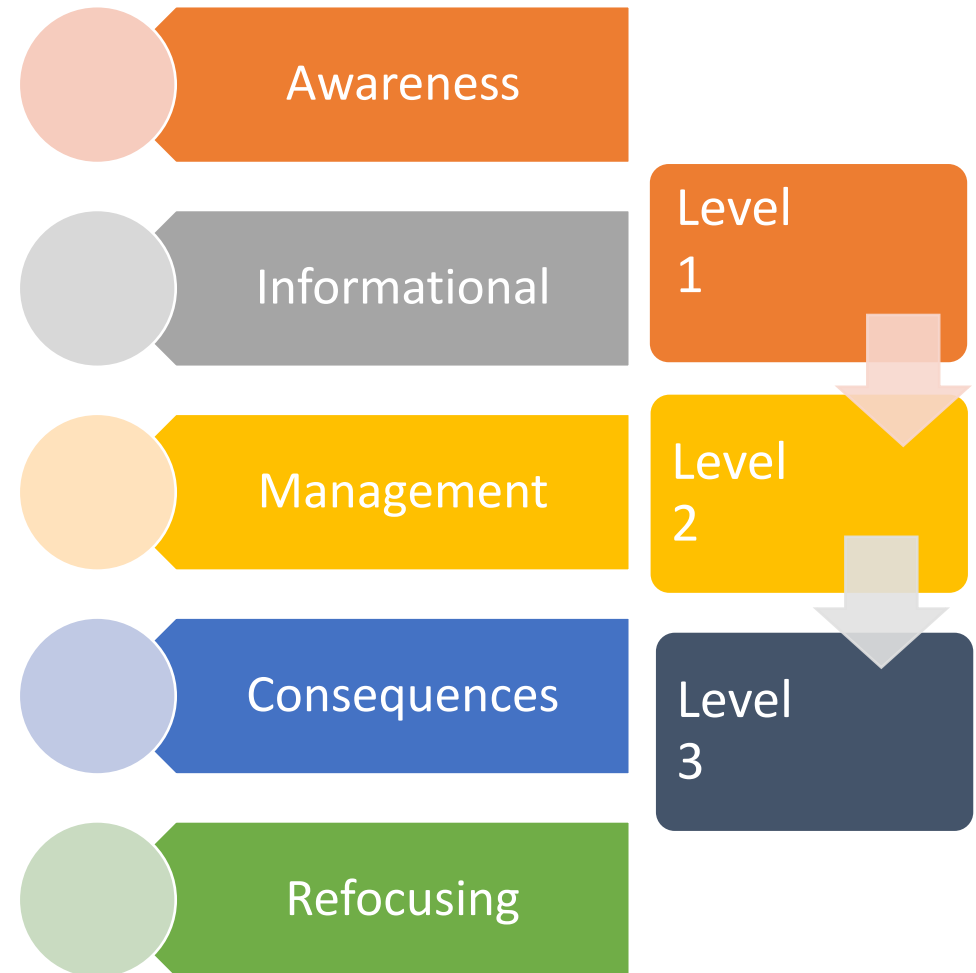
Phase 3

# Concerns & Efficacy Beliefs

Concerns Based Adoption Model (CBAM) -  
Used to evaluate reform by focusing on  
individuals who are most effected  
(Hord et al., 1998)

- Stages of Concern
- Levels of Use
- Innovation configurations

Charalambos & Philippou (2010) adapted  
this model to include efficacy.



Example Questions	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I am sufficiently informed about the goals and the underlying philosophy of the reform.					
I am interested in learning more about how other teachers are using the reform in their teaching.					
The reform minimises teacher preparation time.					
The reform improves students' problem solving skills					
I am concerned about the effectiveness of the reform.					
I feel competent helping my students to solve problems					



# Concerns & Efficacy Questionnaire Results

Factors	Mean <sup>a</sup>	Standard deviation	n
Awareness	2.55	0.77	39
Informational	4.45	0.41	40
Management	3.49	0.38	38
Consequence on students	3.48	0.54	38
Refocusing (negative critique)	3.11	0.47	39
Efficacy beliefs about teaching without using the reform	3.53	0.56	39
Efficacy beliefs about incorporating the reform in teaching	3.57	0.49	39

<sup>a</sup> On a five-point scale (1 = strong disagreement; 5 = strong agreement)

Kendall's W = 0.55,  $p < .0001$

# Level 1 Concerns

Awareness

23 students demonstrated a lack of awareness or expressed a need for more information.

Informational

*“I’m not aware of much of the changes but it mostly depends on how it is taught and examined. I think a major change did have to be made to the syllabus, but I don’t know enough about Project Maths specifically to fully agree with it yet”*

*“I am not fully informed on Project Maths, however my understanding is that it is more like 'problem solving' from junior cert i.e. more text (information). I believe this is a disadvantage to students with dyslexia.”*

# Level 1 Concerns



Awareness



Informational

- Increase number of students sitting Higher Level Mathematics
- Influenced by third level institutions and private sector to increase number of skills graduates
- Address implications of the Leaving Certificate examinations

# Level 1 Concerns



Awareness



Informational

*“Increased participation at higher level. Response to demand from third level institutions and service sector employers for higher-skilled graduates.”*

*“Numbers of those failing maths remained high and Project Maths was introduced to counter act it.”*

*“To get students into STEM careers”*

## Level 2 Concerns

No qualitative responses to management concerns – differing to the statistical responses

# Level 3 Concerns

Consequences

Refocusing

18 participants responded to the consequences of the reform.

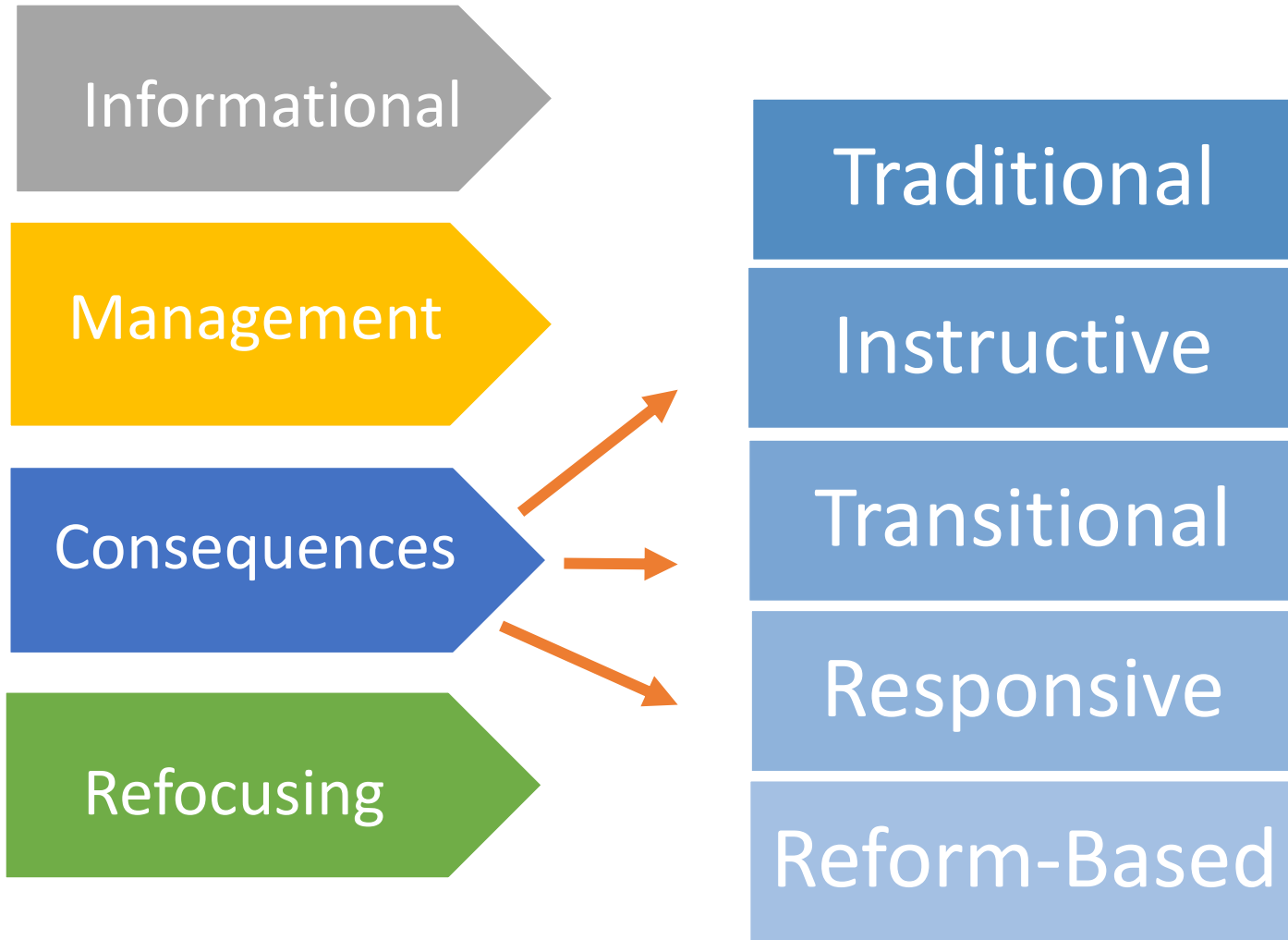
*“There is reform necessary in order to make maths more relevant in today’s world, yet trying to ‘dumb’ it down too much actually makes it harder and more complex to understand.”*

*“I am generally in favour as it allows students to see the use of mathematics in all aspects of life and therefore helps to break down the stigma that maths is really difficult.”*

*“Maths education required a change to include all students in progressing and getting something from their efforts.”*

# Stage 2 & 3 Concerns:

TBI framework (Luft & Rohrig 2003)



# Reform necessary but lack of focus on student learning

## Transitional

*“Make maths more interesting for students, increase its relevance, increase higher level maths uptake and integrate the primary and post primary maths.”*

*“Maths education required a change to include all students in progressing and getting something from their efforts”*

## Responsive

*“It allows students to question certain things and form their own understanding of maths”*



# 3 Main Changes – Coded responses

*“Less choice in what questions you should answer”*

*“Bigger emphasis on statistics and probability”*

*“5 strands to correlate between primary and post-primary”*

*“25 extra points”*

*“Emphasis on applications”*

*“Moving away from drill based learning.”*

*“More focus on student critical thinking”*

Traditional

Instructive

Transitional

Responsive

Reform-Based

# Attitudinal factors:

Factors	Median <sup>b</sup>	IQR	n
Confidence in Learning Mathematics	4.25	1.00	40
Mathematics Anxiety	4.00	0.88	40
Effectance Motivation	4.00	1.00	40

<sup>b</sup> On a five-point scale (1 = strong disagreement; 5 = strong agreement)

# Conclusion

Baseline level of this cohort of pre-service teachers' concerns commencing their initial teacher education.

- Similar level of concerns of participants (quantitative)
- Differing level of concerns in qualitative responses.
- Lack of information and mis-information on the curriculum reform (e.g. Bonus points)
- No focus on implication of reform on teaching and learning of mathematics in the classroom
- Concerns on consequences on the reform exam-focused

# Discussion

Implications for Mathematics Pedagogy educators:

- More information required on the philosophies and research underpinning the curriculum reform
- More information required on changes in approaches to teaching and learning mathematics in the classroom
- School placement and support core to help build PSTs efficacy and therefore implement curriculum reform
- May be a need for more teacher education related to the reform which incorporates PSTs as well as in-service teachers.

# Questions/comments/feedback

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