MARBLE: Mathematics in Australian Reform Based Learning Environments

A negotiated professional learning program in Tasmanian rural schools

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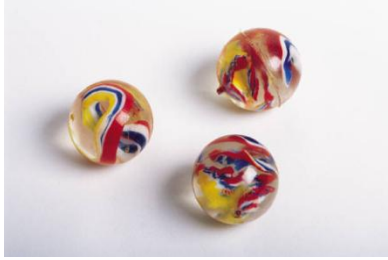
UTAS

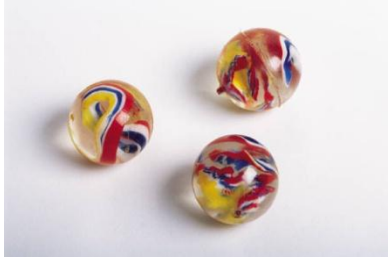
CATHOLIC education office HOBART

The PL program



- 3 years
- Tasmanian Department of Education
- Tasmania Catholic Education Office
- In the context of curriculum change

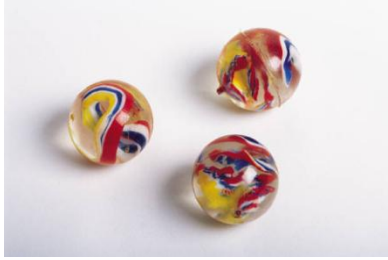
Essential Learnings



- “a curriculum for the 21st century”
- organised around five ‘essentials’
  - *Thinking,*
  - *Communicating,*
    - Being numerate
      - Being numerate involves having those concepts and skills of mathematics that are required to meet the demands of everyday life. It includes having the capacity to select and use them appropriately in real life settings. Being truly numerate requires the knowledge and disposition to think and act mathematically and the confidence and intuition to apply particular principles to everyday problems.

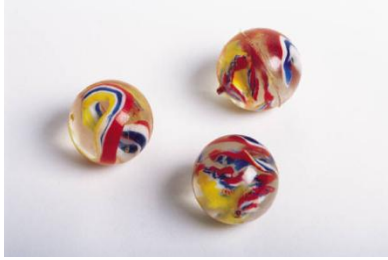
        (Department of Education, Tasmania (DoET), 2002, p.21)
  - *Personal futures,*
  - *Social responsibility* and
  - *World futures*

Our beliefs...



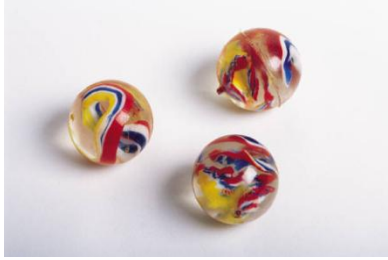
- About teacher knowledge/beliefs/practice
  - We knew almost all were not maths specialists
    - Personally numerate but little if any PCK
    - Largely procedural fluency without deep understanding
    - Mostly sound general pedagogy
    - Low expectations of and aspirations for students
    - Dislike of or indifference to maths
    - Traditional practice – demonstration of procedures followed by practice
    - Use of ‘real life’ to engage students

Our beliefs...



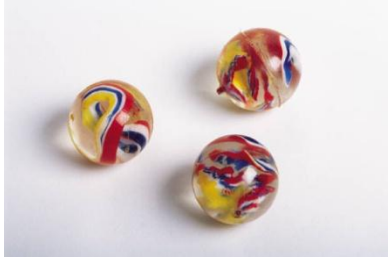
- About teacher knowledge/beliefs/practice for effective mathematics teaching
  - "profound understanding of fundamental mathematics"
  - PCK
  - knowledge of students as maths learners
  - belief that all students can learn maths
  - problem solving orientation
  - positive attitude to mathematics

Our beliefs about professional learning



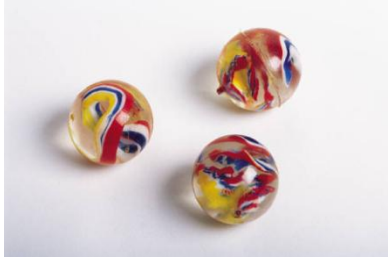
- Teachers will change only if:
  - they see a need for change
  - have available to them a plausible alternative paradigm
- Improvements to student learning results from:
  - deep processes that must engage teachers' underlying beliefs
  - involve much more than the adoption of particular tools or practices
- Effective professional learning:
  - provides opportunities for teachers to have initial and ongoing input into the program
  - provides opportunities to solve problems collaboratively
  - is long term
  - focussed on own students' learning

The teachers



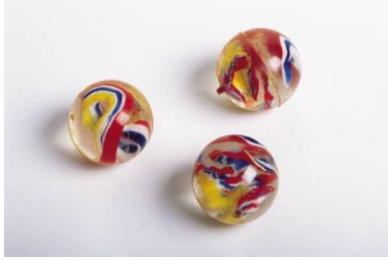
- Two rural school clusters in different geographical regions of the state, divided five and four.
- Eight were government schools and one was a Catholic school.
- Year 1: 42 teachers (~745 students)
- Year 2: 47 teachers, of whom 23 had participated in the previous year (~723 students)
- Year 3: 54 teachers, of whom 20 were new to the project (~934 students)
- 11 teachers participated throughout the 3 years.

The PL program



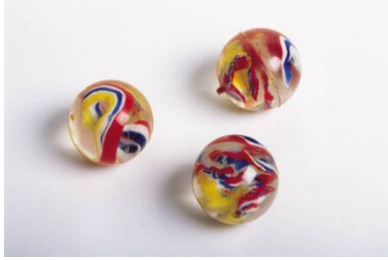
- Incorporation of factors associated with successful PL
  - The education systems and schools were very supportive,
  - Teachers were consulted about their needs on several occasions over the 3 years,
  - There was the continuity of a 3-year program,
  - The leaders attempted at every opportunity to model the teaching strategies advocated,
  - Many opportunities for collaborative problem solving of various kinds were provided
  - All schools had several teachers involved in the project
  - There was the expectation that teachers work collaboratively in their schools as well as when they were at project learning sessions
- Explicit about Shulman's knowledge types and our evaluation processes

The PL program



- Sessions duplicated in the two clusters of schools
- Flexible arrangements to cater for needs of the clusters and individual schools
  - Case studies in individual schools
    - Negotiated with whole schools, groups of teachers, or individuals
    - Several publications with teachers from this work
  - Whole day, half day, and after school sessions
  - Repeated sessions
- Activities designed to address teachers'
  - Mathematical content knowledge
  - Pedagogical content knowledge
  - Knowledge of students as learners
  - Curriculum knowledge

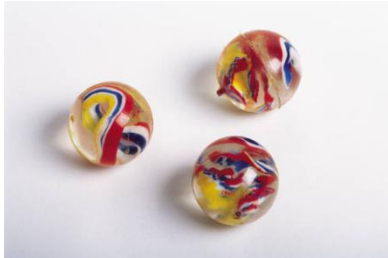
The PL program



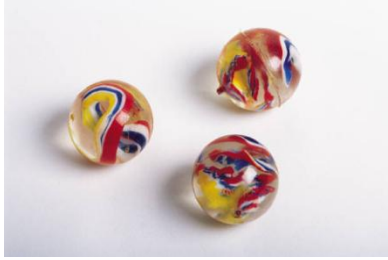
- Expectation that teachers would try something and report back to the group
  - E.g., Work samples
  - Time for sharing at the start of most sessions
  - Time for planning in school groups at the ends of most sessions
    - Informal school leaders
  - Data from own students was powerful

Evaluation of the PL program

- Teacher profile
  - Teachers' knowledge
    - defined broadly in terms of Shulman's (1987) knowledge types,
    - the elaborations of his notions of content knowledge and pedagogical content knowledge described by Ball and colleagues (e.g., Ball, Thames & Phelps 2008),
    - aspects of teachers' beliefs and confidence
- Student survey
  - Impacts on students
    - change in students' mathematical understanding,
    - their perceptions of aspects of their classroom environments,
    - their attitudes to mathematics

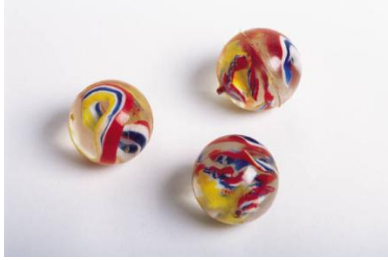


Results



- Improvements in students' mathematical understandings for matched students across each year except for Grade 6 in 2006 moving to Grade 7 in 2007 Watson, Brown, Beswick, Callingham & Wright, 2010
- Improvements in a few aspects of students' attitudes to maths Beswick, Watson, Brown, Callingham & Wright, 2010
- But, very little change for teachers
  - For the 19 teachers who completed both profiles there was improvement in general pedagogical knowledge and negative change re mathematics in everyday life Watson, Brown, Beswick, Callingham & Wright, in preparation Teacher profile

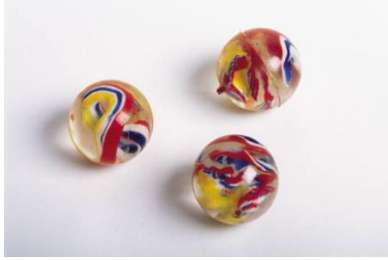
Development of teacher knowledge



- Scale of teacher knowledge
  - teacher knowledge can be conceived of as a uni-dimensional construct that underpins many separate aspects (confidence, beliefs, general pedagogy, CK, PCK)
    - Level 1: Personal Numeracy
    - Level 2: Pedagogical Awareness
    - Level 3: Pedagogical Content Knowledge Emergence
    - Level 4: Pedagogical Content Knowledge Consolidation

(Beswick, Callingham & Watson, forthcoming)

Changing context



- Curriculum change
  - Implementation of the ELs began in 2005 but was withdrawn in 2006 and replaced in 2007.
- Teacher turnover
  - Just 11 teachers throughout the 3 years
- Student turnover
  - Of those students who participated in 2005, just over half also participated in 2006,
  - in 2007, 58% of students had participated in either one or both of the previous years.

Thank you