Policy and practice in early years science and mathematics: Some insights from Malta

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This presentation includes:

- A short description of early years education in Malta;
- Main policy direction with respect to early years science and mathematics education (and relation to creativity)
- Insights into actual practice (teachers' responses to survey and fieldwork)

creative little SCIENTISTS

POLICIES → **Practice**

Governments write policies, educators and administrators implement them.

How often are policies really implemented?

This presentation provides some insights from Malta

Some background about Malta

- Small Country – ½ million but with all gov. structures;
- Highly centralised education system;
- Providers – State (60%), Church (40%), Independent (10%);
- Compulsory education starts at age 5, but many children start at age 3;
- Early years used to include 3-8years, now moved down to 3-7 years;
- Maths is core, Science declared core...
- There is a demarcation between pre-school (3-4 years) and primary education (5-8 years)

Main Research Question

How is teaching, learning and assessment of science & mathematics conceptualised in the early years in Malta? What role does creativity play in these?

Methodology

For policy review:

- **8 policy documents reviewed:**
  - The National Minimum Curriculum, 1999
  - Towards a Quality Education for All: National Curriculum Framework Consultation Documents 1-4, 2011
  - Vision for Science Education, 2011
  - Early Childhood Education and Care: A National Policy, 2006
  - National Standards for Childcare Centres, 2006
  - Draft National Children's Policy, 2011
  - The Record of Development and Progress at Kindergarten level, 2011
  - National Policy and Strategy for the Attainment of Core Competencies in Primary Education, 2009

  - **Updated by the recent National Curriculum Framework (2013)**

Teachers' Survey: 139 responses

Schools Sector	Percentage %
Preschool	35.25%
Primary School	64%
Missing	0.75%
Schools Sector	**Percentage %**
State Schools	69.8%
Church Schools	21.58%
Independent Schools	8.63%
School Staff	**Percentage %**
Female	93.5%
Male	3.6%
Missing	2.9%

Fieldwork

- **Focus**: finding ‘good practice’ where children’s creativity is fostered and where the emergence of appropriate learning outcomes is achieved
- **Age group**: 3 – 8 years
- **Sample:**
  - 2 Church primary schools (5 year olds; boys)
  - 1 Independent primary school (7 year olds; mixed +1 pre-school 3 year olds)
  - 1 State primary school (8 year olds; mixed)
  - 1 Church primary school (8 year olds; girls)

  - 6 teachers/ 20 episodes

Science

Rationale/ Vision	Awareness of immediate environment (NMC)	Scientific literacy & developing thinking skills using evidence-based approach; Producing scientists; Science in early years curriculum. (VSE)
Aims & Objectives	Kindergarten: *Intellectual Development – Understanding The World We Live In* explore with senses, observe, choose & handle object, similarities & differences, construct, likes/dislikes, questioning why. (Pre-school)	Inquiry Based Learning; Develop scientific skills through observation (3-5); Developing language through questioning, labelling & identifying (3-5); Understanding through questioning, find ways to answer questions, investigate, communicating, linking science to everyday life (5-15) (VSE)

Science

	Pre-School	Primary Level
Content	*Intellectual Development – Understanding The World We Live In* (implicit mention of similar scientific skills)	No reference to specific topic; Skills addressed involve understanding, investigating with senses, communicating, linking and applying science.; Process of science instead of content (IBSE); Activities: observe, examine, try things out, predict, hypothesise & obtain results to be able to make associations, remember, recall, understand. (VSE)
Learning Activities	Change towards Inquiry Based Learning: curiosity, observation, inquisitiveness, questioning, investigate, construct own scientific understanding; 5E: Engage, Explore, Explain, Elaborate & Evaluate; Discovery areas in classrooms;	

Science

	VSE (early years)
Materials & Resources	Curriculum materials & Laboratory facilities & Multi-media resources
Grouping	Socio-Cultural learning theories shift; Inquiry learners investigate in groups.
Assessment	Assessment for learning, participatory activity; learners assessing their work & others; Tools – investigation, problem solving, learning logs & portfolio, individual/ peer assessment, formal assessment & tests

Mathematics

	RDP	NCF
Content	Intellectual development: number identification, counting to 10, addition, subtraction, problem, differences in quantity, greater, smaller, heavier, lighter, mathematical language, understanding of shapes and space.	Numeracy skills, Creative approaches in the use of measurement, space, shapes & data handling, logical and sequential thinking, positive attitude, use mathematical vocabulary to express self, strong foundation in basic mathematical skills, problem solving through investigation
Learning Activities	Inquiry Based Learning promoted across all subjects, however there is no specific conceptual change in Mathematics towards IBL.	
Assessment	Very specific and formal assessment is encouraged to test these specific skills.	

Creativity

	Pre-School	Primary
Rationale/ Vision	Creativity development linked to expressive arts. *However skills listed such as 'exploring textures, form & space through different media and respond to sensory experiences' can be linked to science.*	Promoting creativity and innovation as a cross-curriculum theme across varies subjects
Learning Activities	Creative development linked to arts.	Creativity linked to innovation as cross-curricular themes. No example how to promote it through different subject areas; Innovation through IBL links creativity to science

Survey results

Rationale or vision: Why are children learning?

- Scientific literacy & numeracy for society & individual (awareness & responsibility, positive attitudes) (m: 3.67)
- Science & Math education promoting general skills & dispositions for learning (m:3.54)
- Innovative thinking not very important (m: 2.75)

Aims & objectives: Toward which goals are children learning?

- Affective aspects (promoting positive attitudes) (m: 3.65)
- Social factors (collaborative learning) (m: 3.56)
- Process of science (planning & conduct a simple investigation) (m: 3.1)
- Capabilities to carry out scientific inquiry & problem solving based activities (asking questions) (m: 3.21)
- Knowledge & understanding of science content & scientific inquiry is the least important

Learning activities: how are children learning? Inquiry activities

- observation of scientific phenomenon (m: 3.47)
- pose questions (m: 3.22)
- conduct investigation (m:2.69)
- communicating results (m: 2.60)
- Least important: Making up conclusion and explanations (m: 2.27)

Learning activities most likely to contribute to development of creativity

- Most likely: observe natural phenomenon 77.7% & asking questions 60.4%
- Least likely: Use data to construct reasonable explanations 9.4% & communicating explanations 15.1%

Degree of open/guided or closed inquiry activities in classroom

- Most common: guided and structured inquiry activities.

Pedagogy: how is the teacher facilitating learning?

- **Most common:**
  - Dialogue & collaboration; promote work in small groups
  - Problem finding & problem solving as context for science teaching
  - Storytelling & role play
- **Less Likely**
  - Outdoor activities & fieldtrips to museums

Pedagogy promoting creativity

- **Preschool:** open activities, unstructured play, role-play & pretend play
- **Primary:** Physical manipulation of materials, expressing own ideas & problem solving/ problem finding

But what is actually happening in classrooms?

Some Fieldwork Activities

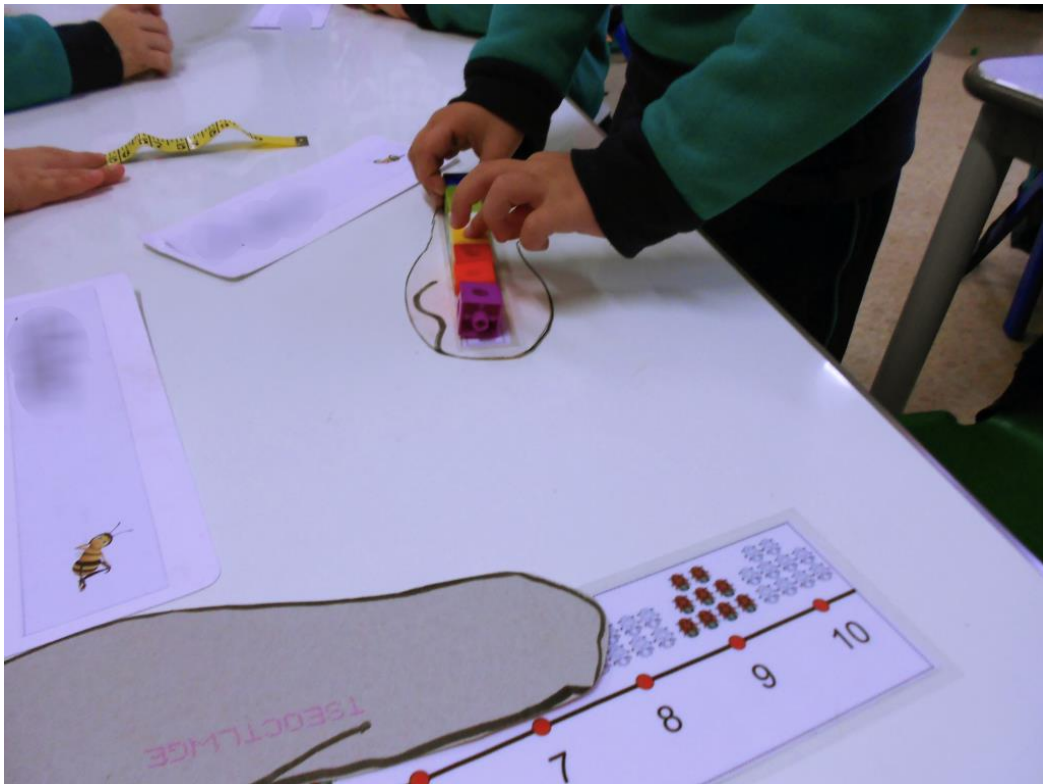
Preschool Measuring Robot

- Basic skills in measurement, foundation of measurement in mathematics using scales
- Manipulating materials: blocks & pegs
- Creative aspect: children comparing other objects from own experience (Eiffel tower) with height of robot

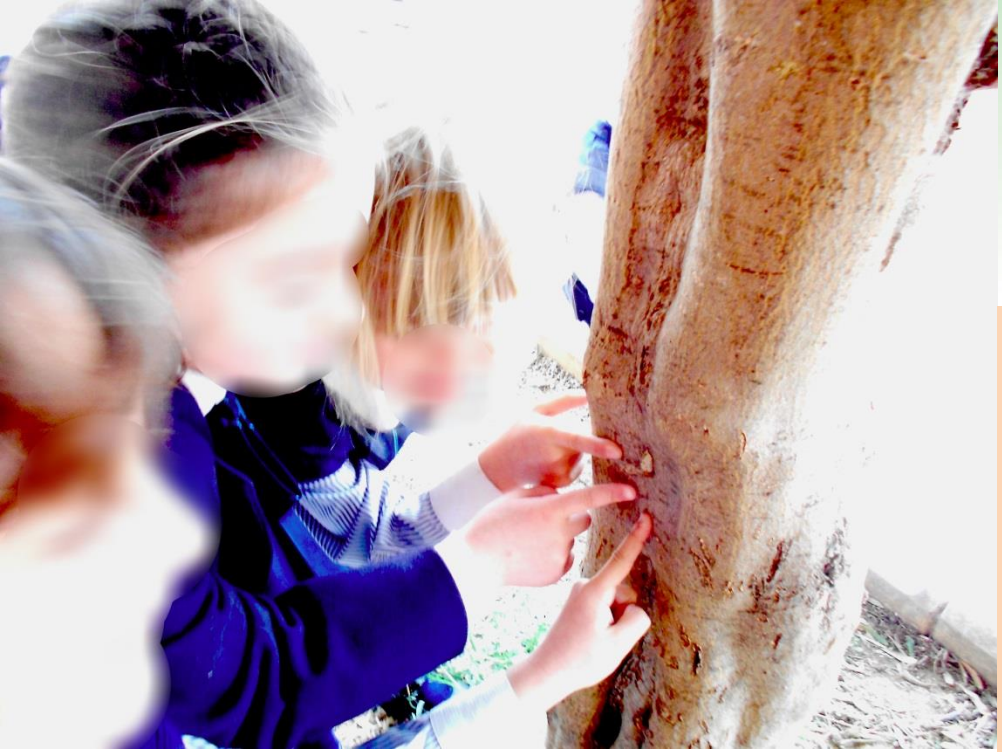
Preschool Feet

C: ‘*You can do it like this’ (holding the measuring tape against the cutout. He is still not aware that he needs to start from 1cm)*

- Exploring different materials to use when taking measurement
- Variety of materials (blocks, measuring tape, paper ruler) to measure length
- Foundation to measurement in mathematics
- Creative aspects: how the children interacted with the different measuring tools & collaborated together to show each other how to use materials.

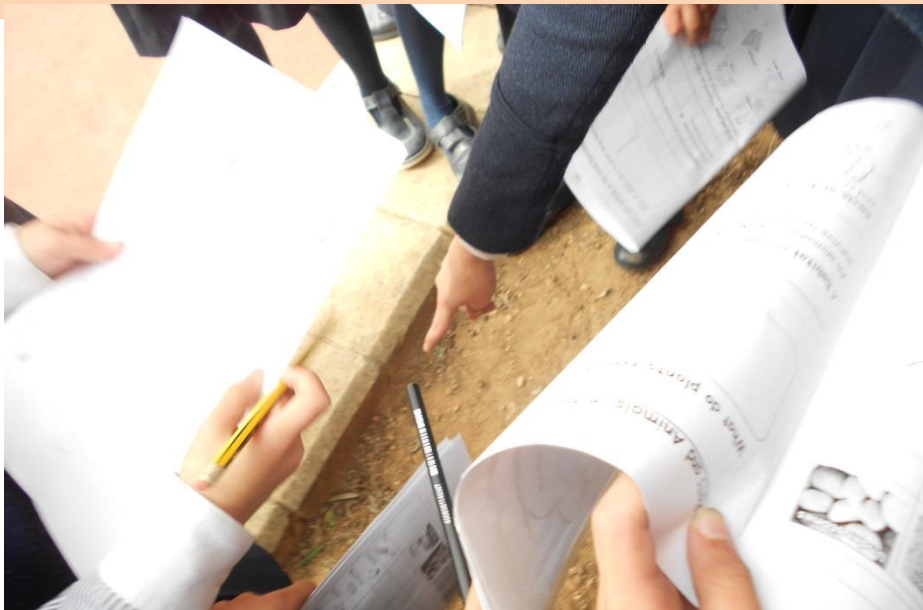


Primary Minibeasts



C_1 *'See what this is…'*
C_2 *'That is a pupa…it was a caterpillar once.'*
C_1 *'Yes we had one in our garden…it turns into a butterfly.'*
C_2 *'Look how it is stuck to the tree. Will it fall?'*
C_1 *'How long do they take to become a butterfly?'*

- Science Inquiry: observe, find & record any living things & insects (minibeats) and their habitat
- Observation skills & knowledge of their local environment & knowledge of conditions present in natural habitats
- Creative aspect: Freedom to explore used by children to express ideas to their peers & develop and communicate meaning



Primary

Shooting Balloons

- Science: how air going out of a balloon exerts a force on the balloon making it move forward.
- Inquiry in Science: Research question brought forward by teacher, prediction by students, testing prediction with a structured experiment, reflecting on observations & link the evidence to the original question.
- Creative aspect: Predictions & suggestions brought forward by students to try out balloons of different sizes. Inquiry stimulating imagination

T 'What happened?'
– **C** 'The faster one was the first.'
– **T** 'What was your prediction? The more air in the balloon...'
– **C** 'The faster it goes.'
– **T** 'What happened ... this stopped, why? Don't touch it...this is evidence.'
– **C** 'It did not have enough air...it was all out.'

Comparing Policy and Practice

At policy level

- Recognition of early years as separate from primary education;
- Main aims are scientific literacy and understanding of nature
- Recognition of science as a core subject at primary level;
- Commitment to Inquiry-based learning in Science

At practice level

- Pre-school and primary split early years education;
- Main aims focus on affective and social aspects of science;
- More time needs to be dedicated to science by teachers;
- There is a slow shift towards inquiry science at primary level

Creativity

At policy level

- Term innovation is used rather than creativity;
- This is promoted cross-curricular;
- Concept is vague and not expanded through practical examples.

At practical level

- There is evidence of creative teachers;
- Less focus is given to ‘teaching for creativity’
- The role of creativity in science and mathematics in the early years still needs to be improved.

Conclusion

Malta has recognised the importance of promoting creativity as part of compulsory education,

however

there is need for better understanding of how creativity can be promoted in the early years, particularly through mathematics and science