

TOWARDS A CPD FW FOR THE NCETM

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Participants were prompted to consider core issues concerning CPD, then presented with a window on what might be possible via the NCETM CPD FW website. The session ended with questions and issues centred on the PedMaPedia (the component which it is hoped will develop into a wikipedia for mathematics related pedagogy).

BACKGROUND

Lynn Churchman asked me to assist her formulating a CPD website that had a chance of supporting and influencing those involved in teaching and mathematics, and in particular, those offering relevant PD. To this end a small group of people have been developing a vision of what might be possible, for implementation by NCETM

The NCETM site has already begun to fill out a *directory* of PD provision available in England, through the agency of its regional coordinators. That directory will provide one-stop access to all pertinent government agency sites (such as TDA, GTC, OfStEd etc.), all associations (MA, ATM, MEI, ...) and other agencies (NAGTY, SST, UKMT etc.); all PD providers (HE, LEA, independent) as well as a directory of where to obtain *didactic devices* (number fans, slates, rods, blocks etc.).

The site is also developing a *user community* which will include commissioned blogs, personal spaces, discussion fora etc..

Perhaps the most exciting if not overwhelmingly daunting is to initiate a wikipedia dedicated to mathematics education, called variously the **Pedagogical Mathematics encycloPedia**, or PedMaPedia for short, or more recently, the **Mathemapedia** - The **Pedagogical EncycloPedia** for all teachers of **mathematics**). An essential ingredient is that the community as a whole participate in editing and extending it, which involves trusting everyone to act and contribute professionally to a growing inter-articulation between specialist groups such as ESL, Early Years, SEN, etc. but also practicing teachers, PD providers and HE researchers.

The session

Participants were invited to complete the following prompt, acknowledged as far too generalised:

If only every teacher would ...

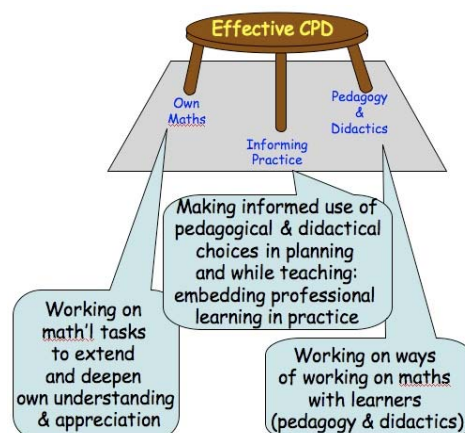
Then they were asked what they considered the principle issues about PD provision to be.

The first prompt generated considerable discussion in small groups, and so served to orient people towards what the **Mathemapedia** aims to provide. The second was less useful, apparently because there weren't a vast range of issues. I had in mind things like: 'how do you reach those who eschew PD so as to inspire and excite them about

what they might be missing?', and 'what are the psycho-social conditions under which PD is actually effective?' and "Does accreditation really matter, and when it does, what is required?".

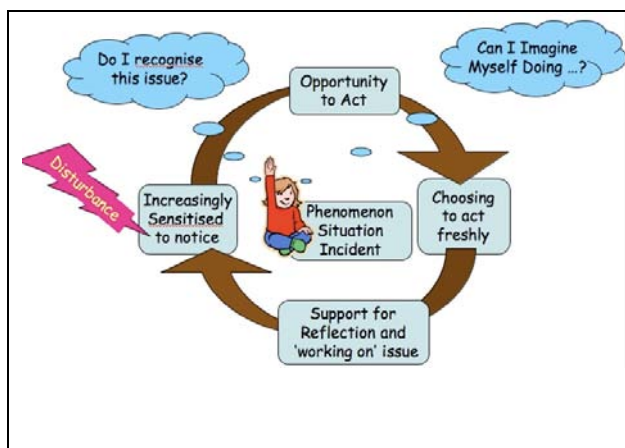
EFFECTIVE PD AND CPD

PD can take many different forms, but in order for it to be effective in the long run, that is, to influence teaching and improve learners' experience of mathematics, three essential components have been identified: **mathematics content knowledge, subject specific pedagogy** and **embedding in practice**. CPD should be cumulative and sustained over a period of time leading to appropriate recognition and/or accreditation. A major role for the NCETM is to achieve coordination of provision across



agencies in order to address national priorities [DfES Chief Advisor for Mathematics, policy paper]. The tripod emphasises the interconnectedness of the three strands, and the necessity of each for effective professional development. The FW promotes the tripod metaphor by inviting use of the three legs to structure entries in the databases.

The terms *pedagogy* and *pedagogic* are used to refer to strategies and tactics which can be used in almost any topic and in almost any lesson. By contrast, the term *didactic* is used to refer to issues of teaching a specific mathematical topic. Thus the use of the empty number-line to work on counting-on is a didactic issue, whereas pausing to get learners to discuss something amongst themselves, or to construct a mathematical object like one under discussion are pedagogic strategies because they can be used in any lesson and with any topic.



We are currently working on the basis that the key questions for any PD participant are "Do I recognise this issue?" and "Can I imagine myself doing ... in my situation?". This means that the key question for PD providers is "How can I support practitioners in recognising and experiencing a disturbance, and imagining themselves acting differently in the future?".

THE MATHEMAPEDIA

The CPD FW website being developed by the NCETM aims to develop into a comprehensive resource for everyone involved with teaching pertaining to

mathematics, through the PedMaPedia as a user–editable comprehensive source of pedagogy and didactics.

The categories and the forms for populating with records are still under development. A partial list of items is appended: some of these will spawn multiple records, others may form individual records.

Access to items in the *Mathemopedia* will need to be by Items from the Surface Access Routes; Simple and Boolean Search; Index of Items; Drop-down or pop-up index of categories; Blob-Maps or Topic-Webs.

CATEGORIES OF (COLLECTIONS OF) RECORD ITEMS

This is for the moment at least, an unstructured database consisting of a large number of interlinked nodes, grouped into categories so as to aid search and indexing. A few illustrative examples are offered for each category.

Issues & Concerns ...

Descriptions of concerns raised by TAs, NQTs, teachers, coordinators, HoDs etc. together with links to ways of addressing these concerns (*Networks, Agencies & Events, research evidence, advice on how to, Pros & Cons for ...*).

Probes for inviting people to consider these, and to use with colleagues to get them to collaborate in considering them.

... about Mathematical Topics

links to dictionaries for meaning of various terms (and where they are described in the National strategy and QCA documents)

Didactical issues about use of devices; links to general pedagogical possibilities

... about Teaching Mathematics

Planning Lessons; Types of Tasks

A collection of examples of types of mathematical tasks and what they can be expected to achieve

Examples; Sorting tasks (Malcolm Swan's DfES work)

Construction tasks; In How many Different Ways Can You ...

Interacting with Learners

By KS, by type: Types of questioning; promoting discussion and other interaction; design of tasks; types of tasks (Prestage & Perks; Watson); lesson plans; Changing Your Practice; Motivating and engaging Learners; Joining or forming a Collaborative Group;

Asking Questions Mathematically

Promoting Pedagogically Effective Discussion

Working with second language students on mathematics

Mixed Ability Teaching; Teaching Inclusively

Challenging all learners appropriately

Use of specific didactic devices (empty number-lines, dynamic geometry, spreadsheets, number fans, stoplights, white boards, interactive smart boards etc.)

Motivation and Truancy

... about Career Development

Preparing to Become a ...

Advice on what sorts of things to work on and what sorts of CPD evidence would enhance a portfolio in order to become a Teaching Assistant, NQT, Advanced Skills Teacher, Maths Coordinator, HoD (or deputy), PD provider, Mentor (for PGCE, NQT, ... novices), PGCE Tutor, LEA Consultant, Research Assistant, Research Fellow

Links to TDA and other agencies with statements of standards and expectations.

... about PD itself

How to Engage in and Benefit from PD

A collection of items offering advice on how to engage in PD yourself and with colleagues: How To Initiate a collaborative group of colleagues; How to Sustain a collaborative group of colleagues; How to Embed some ideas into your practice; How to Create a portfolio of CPD evidence; How to sensitise yourself to learner difficulties; Links to research items, other resources

Rationales for PD

A collection of justifications and inspirations for engaging in PD

Links to User-Community reports on *What PD has done for me* etc.

Why engage in PD?; Rationales for this FW

A collection of justifications for the current structure so as to inform future development and modifications: Aims and Intentions of the FW

Effective PD (tripod image) justified

Obstacles

A collection of classic learner obstacles which give rise to confusions and mistakes. References to research literature, to classic research probes, and to proposals for circumventing them: Whole numbers, fractions and decimals are different things; Reference to sorting tasks (Malcolm Swan DfES work).

Conceptual: classic confusions such as ratio-proportion, ratio is additive; if in doubt use linearity; Multiplication and addition make bigger; division and subtraction make smaller; formula are for memorising not manipulating; $0.12 > 0.3$; adding tops and

bottoms of fractions; Fruit Salad Algebra (a is for apples rather than the mathematically correct a is for the number of apples); ...

Emotional: fear of failure (I can't \rightarrow I don't but I could try to); accepting low expectations of teachers, parents and institutions; Lack of Time; Lack of Opportunity; Lack of Freedom; ...

Behavioural: needing time to think things through; ... Anticipating and Falling behind; concentration spans; physical coordination;

Pedagogical Strategies

Examples: Same & Different; Another & Another; Interchanging Given and Sought;

Didactical Tactics & Devices

A collection of (descriptions and pictures of) of physical devices briefly described, with brief description of types of situations in which they are useful; Theoretical bases for their use; Questions worth considering about how they are used; Links to where there is more information about research and practice (including in the National Strategy etc.). E.G. white-boards; number fans; dynamic geometry; empty number-line; balance metaphor for equations; Dienes and multibase blocks; unifix cubes; interactive-white-boards, LOGO, Spreadsheets; Graphical software; calculators; Four Function calculators; specific software etc.; interlinkd with specific mathematical topics; Say What You See; Watch What You Do; Tracking Arithmetic; Reading Graphs; Interpreting Data; Reading Statistical Displays;

Pedagogical Constructs

Examples: Dimensions of possible Variation & Range of Permissible Change; Do-Talk-Record; Manipulate-Get-a-sense-of-Articulate; Enactive-Iconic-Symbolic; Directing Attention; Instrumental & Relational Understanding; Pirie-Kieran (onion) model of Understanding; Exercise as Object; Structured variation; Scaffolding & Fading; Structure of a Topic; Stressing & Ignoring; Posing Problems; Fluency & Facility (diverting attention so as to gain these); Didactic Transposition; Theorem-In-Action; Collaboration & Cooperation;

Mathematical Themes

Examples: Invariance in the Midst of Change; Doing & Undoing; Freedom & Constraint; Extending & Restricting; Changing (re)Presentation; Modelling;

Case Studies

Accounts of lessons which are or become cross linked to pedagogical constructs which serve to justify intentions and account for observations; accounts of mathematical explorations with commentary informed by theoretical constructs.

Study Skills (Mathematical)

Examples: Imagining & Expressing; Specialising & Generalising; Conjecturing & Convincing; Constructing own examples; Easy, Hard, General (Bills);

Beliefs & Assumptions

Articulations of beliefs and assumptions that people often make about mathematics teaching and learning which, when brought to the surface and articulated, may be reconsidered or refined.

Research database

A linked bank of research papers and other reading – each item linked from if not to relevant aspects of the PedMaPedia

Mathematical Topics

Including developing maps of the didactic structure and components of specific topics: Additive Domain: topics, reasoning and thinking; Multiplicative Domain: topics, reasoning and thinking; Mensuration Domain: topics, reasoning and thinking; Geometrical Domain: topics, reasoning and thinking; Data Handling and Display Domain: topics, reasoning and thinking; Algebraic Domain: topics, reasoning and thinking; Graphical Domain: topics, reasoning and thinking

It is our (John Mason, Lynn Churchman, Heather Scott, Pete Griffin, Graham Smart) hope that colleagues will become enthusiastic about the possibilities afforded to interact with teachers, to stimulate and support effective CPD, to influence colleagues and to integrate research constructs and findings with practice in order to improve learners' experience of and exposure to mathematics.