



## REPORT ON THE 2012 RESIDENTIAL FOR TEACHERS OF MATHEMATICS AND SCIENCE

24<sup>TH</sup> - 26<sup>TH</sup> MARCH 2012

HELD AT THE MØLLER CENTRE, CAMBRIDGE

### TABLE OF CONTENTS

PRESENTATIONS BY SUBJECT LEADERS.....	-3-
PLENARY PANEL DISCUSSION in response to subject presentations.....	-5-
SCHOOLS PRESENTATION AND PANEL DISCUSSION.....	-8-
SELECTION OF QUOTES FROM DELEGATE EVALUATIONS.....	-10-

## PRESENTATIONS BY SUBJECT LEADERS

### Monday 26<sup>th</sup> March

Conclusions of all the delegates' discussions at the Residential were presented by the Subject Leaders to a panel of educationalists on the final afternoon. There were two presentations and this section summarises their reports.

#### **1. The value of the PTI Residential**

Delegates found the following aspects of the course particularly valuable:

1. The Pupil Panel
  - Reminding teachers of the impact they can have
  - Highlighting the sense of pride and fulfilment when teachers succeed in inspiring them.
2. The Lectures
  - Numerous demonstrations of the wonder and awe of the subject
  - Sources of rekindled passion, and broadened and updated knowledge
  - Stimulating and practical suggestions for use in the classroom
  - Indicative of what it takes to be a successful mathematician or scientist.
3. The Workshops
  - The benefits of being related to the lectures and involving the lecturers themselves in discussions with teachers
  - Illuminating topics, raising aspirations, sharing good practice and determining clear and challenging objectives.
4. General
  - The opportunity to hold discussions with professional colleagues, in both formal and informal contexts, away from the everyday pressures of one's working environment
  - Creating a network of professional contacts with a variety of schools
  - Clarifying key issues in teaching and learning, and working towards practical solutions
  - Highlighting the importance of high quality subject-based CPD.

#### **2. Current Issues**

The following were outlined as key issues facing teachers of Mathematics and Science:

##### Mathematics

1. Curriculum:
  - In relation to *transition*, the levels of attainment of children at the end of KS2 - and therefore their ability to embark on KS3 - vary enormously. To bridge the gap, the delegates felt there should be more subject-based CPD in Mathematics for Primary School teachers, and more rigour and challenge in the KS2 syllabus. There was also perceived to be a gulf between the requirements of GCSE and A Level. This could be met by the reintroduction of an Intermediate tier in the GCSE, or by having two GCSE Mathematics papers, one on Methods and one on Applications.

- In relation to *change*, constant amendments mean that teachers have to concentrate on familiarising themselves with the new specifications at the expense of ways of making their teaching more effective and inspirational. This was felt to be compounded by having different exam boards competing for custom.

2. Assessment:

- Having recourse to accelerated or repeated GCSE sittings may gain League Table points, but the delegates did not think this the best way of acquiring proper conceptual understanding of the subject.

Science

1. Curriculum:

- The delegates felt that *change* should be planned in a logical order (e.g. KS4 objectives determined before KS3 specifications are planned), after due consultation with the profession, and course materials made available in advance.
- In relation to *content* the delegates felt that courses should explain why Science is important, offer scientific literacy to all, and contain the challenge, rigour and interest to stimulate specialism in Science. Time should then be allowed to embed the syllabus without the disturbance of constant change.
- In terms of *direction*, the delegates felt that the curriculum should no longer be a political instrument but handled by an independent academic body like a revised QCA.

2. Assessment:

- It was felt that controlled Assessment wastes teaching time and demotivates pupils
- It was agreed that practical work is essential to the study of Science and needs to be encouraged
- There was consensus that exam results afford only a partial view of a pupil's capabilities.

# PLENARY PANEL DISCUSSION IN RESPONSE TO SUBJECT PRESENTATIONS

Monday 26<sup>th</sup> March

Chris Pope	Chair, Co-Director, The Princes Teaching Institute
Liz Francis	DfE, formerly Director of Workforce Strategy, TDA
Caroline Hurren	Programme Director of Regional Science Learning Centres
Paul Steer	Partnerships Director OCR
Alida Allen	Forge Valley Community School
Alastair Cuthbertson	Ivybridge Community College

Summary of the main points raised in discussion of issues outlined in presentations:

## 1. Curriculum

Does a curriculum that is accessible to all necessarily disadvantage abler, more aspirational pupils who need a higher level of challenge?

- Challenge can be a function of content, assessment or pedagogy. It is not impossible to differentiate by means of assessment, as at University; but the discontinuity between Key Stages 4 and 5 needs to be taken on board in the National Curriculum Review.
- The original specifications for GCSE were tightly drawn by QCDA, but subsequent modifications intended to serve a number of different ends have resulted in a compromise that fully satisfies nobody. The process is further distorted by the pressure on schools to get extra League Table points.
- Recognition of the complexity of the problems has resulted in a sensible decision to postpone the new GCSE specifications until 2015. The stated intention is then to incorporate a higher level of challenge, perhaps with three years for KS4, which will do something to close the gap with A level. But it will remain to be seen whether GCSE can properly serve the needs of the whole cohort, particularly at the lower end of the ability range.
- There is a similar problem of discontinuity at the end of KS2, where widely differing standards of teaching and levels of attainment produce unreliable foundations to build on for KS3. Secondary Schools can take a lead in tackling this problem by providing subject-based CPD for their local Primary Schools – as some are successfully doing already as part of their PTI Schools Programme.
- These are difficult and important issues requiring wide consultation in which schools are urged to take an active part.

The curriculum seems to be in a continuing state of flux and teachers long for stability. Is this attainable – perhaps through an independent body such as a resurrected QCA?

- The aim of the National Curriculum Review is to reduce the core and leave greater freedom for schools to determine their own curriculum. There are however particular skills in curriculum design which teachers will need to acquire.
- Good teachers are quite used to creating their own Schemes of Work, but the limiting factors are time and resources, and expertise that only extends to particular areas.
- Many of the solutions lie in high quality, well focused CPD.

## 2. Assessment

The disadvantages of having competing, commercially-driven Exam Boards are widely publicised. Would it be better to have a single non profit-making examining body?

- The former independence of Exam Boards has been substantially undermined by the Government and it is time for a new approach involving close cooperation with teaching professionals, both at school and University.
- If there were to be a single Board, it would have to be truly independent. (The independence of the IB does not provide a true parallel as it has the advantage of international status).
- It might be possible to have one Board offering a range of specifications. However, there are evident dangers in a monopoly and there is nothing inherently wrong with intellectual competition.
- Close commercial relationships between Exam Boards and publishers are distinctly unhealthy; textbooks tied to exam specifications are bound to discourage wider reading.
- An Exam Board does have an obligation to ensure that support material is available for a particular syllabus, but this can be done on a non-profit-making basis.

A student on our pupil panel commented that exams only focused on a limited range of the work she was doing. How can we encourage, recognise and assess achievement across a wider range?

- There are other forms of incentive and other contexts for assessment at every level from the classroom upwards, including local, national and international competitions.
- Enrichment activities inside and outside the classroom are important stimuli and the provision of them should form part of the evidence of what makes a good school.
- Activities that are the subject of assessment will always tend to be given priority in schools. Therefore Inspection holds the key. Subject enrichment in all its forms should be formally recognised and rewarded.
- There is a real shift of emphasis in Ofsted inspections. They will now focus much more on the quality of teaching and learning, whatever means are used to achieve it. Inspectors will want to know about subject-specific CPD for instance, and that is a step in the right direction.

How do Exam Boards manage to stay up to date and keep pace with advances of knowledge e.g. in Science?

- By the time an exam paper is sat, it will have been two years in development. This means that, although it may not be absolutely up to date in every particular, it will be valid in all essential aspects.
- There is a continuous process of consultation, involving a close relationship with HE in subject specific forums, a two-way dialogue with teachers, and collaboration with experts in exam specifications.

...and finally

What thoughts will the guest members of the panel take away with them from this afternoon's discussion?

<b>Stephen Sparks</b>	An interest in following the PTI and its work
<b>Paul Steer</b>	Determination to contact a group of PTI teachers and involve them in discussion about examining and assessment
<b>Liz Francis</b>	The need to <u>embed</u> change, with the help of informal teacher advisory groups
<b>Caroline Hurren</b>	Feedback to Ofsted and the Regional Science Centres, and ensuring that CPD reflects the PTI priorities in support of the curriculum.

# SCHOOLS PRESENTATION AND PANEL DISCUSSION

Saturday 24<sup>th</sup> March

The Schools Presentation and Panel Discussion took the form of two presentations by teachers and students from schools in the PTI Schools Programme, followed by a pupil panel.

## Presentations by schools in the PTI Schools Programme

Two teachers and two students from Ark Academy and one teacher from Desborough School gave presentations on their involvement in the PTI Schools Programme.

### 1. Ark Academy, a 3-16 Mathematics Specialist School

- Maths teachers Aishling Ryan and Emi Ozeke explained how their department's involvement with the PTI had helped to shape the vision of Mathematics in the school, with regular celebration of the subject and a variety of enrichment activities both inside and outside the curriculum
- Two of Aishling Ryan's pupils, one year 7 and one year 8 then described how they came to "love Maths" – because of the constant challenge, the encouragement to lateral thinking, the wide range of questions tackled (e.g. "Is beauty mathematical?"), and the spirit of competition.

### 2. Desborough School, a Boys 11-18 Comprehensive

- The Head of Science Ed Brockett described a range of PTI Schools Programme projects undertaken and the lasting effect that they had. These included:
  - i. Masterclasses in particular topics in Physics
  - ii. Engagement with a University Department, thereby gaining access to sophisticated equipment
  - iii. Training sessions with local schools
  - iv. An introduction to practical work for Primary School pupils; carried out by VI Form students under teacher supervision
  - v. A Science, Engineering and Technology Week, including a lecture by 'Galileo'.

## Pupil Panel

On the pupil panel were two year 11 Mathematics pupils from Stewards Academy in Harlow and two VI Formers studying Science from the Robert Clack School in Dagenham. They each made a short statement about why they enjoyed their subject, why it was of value and how it was best taught.

In further conversation with the audience of teachers the pupil panel responded to questions about the teaching of maths and science. The main points arising from these discussions are summarised below:

### The value of learning Mathematics and Science

- Mathematics and Science are an integral part of the everyday world around us and studying them helps us to understand it
- They also satisfy curiosity about matters inaccessible to the senses, from atomic particles to astrophysics
- A better understanding of the world will help us to improve it
- The logical structures involved in studying these subjects have wider applications in problem solving.

### Key elements of good teaching

- Passion and imagination in the teacher; just learning from textbooks is boring
- Encouragement to work things out for oneself
- Study of real-life applications (to enhance but not replace the understanding of concepts)
- Practical work in Science
- Going beyond the syllabus in pursuit of topics interesting in themselves
- Related extra-curricular activities.

### Messages for makers of education policy

- The gap in the level of understanding required between KS4 and KS5 is huge; there needs to be some more challenging elements in GCSE
- Pay more attention to what pupils think and say
- Exam results taken on their own, only give a very partial account of a pupil's capability
- Constant curricular change does nothing to improve pupils' understanding of subjects.

## Selection of quotes from Delegate Evaluations

“The most inspirational, relevant, enriching, engaging three days of my professional career. Multiple opportunities to discuss, develop, share experience and ideas which challenged my thinking.”

“The opportunity to take time out and become immersed in such a positive, energetic, inspiring atmosphere has allowed me to reflect on the importance of maths in an unprecedented way. Thank you.”

“I feel that I have taken a lot from the weekend from ideas and specific activities in the classroom to a more over-arching philosophy. It's great for me to see a variety of ways of progressing professionally too.”

“Some of the discussions in our group sessions have led me to remembering why I love my subject and the job I do. I have had a wonderful and enlightening experience that I will continue to value. I feel better equipped to build a better supported and investigative curriculum with my team. “

“It has made me think why I teach maths, but more importantly, I have reflected on the way in which it is delivered, and how even with all the problems we face we can still be that inspirational teacher.”

“This has been the most inspirational and enthusing CPD I have attended for years. The renewed enthusiasm and enrichment I have has reignited my desire to do more for our students. Excellent opportunities to discuss and challenge thinking.”

“It's been fantastic to see truly passionate and inspiring academics who have reminded me why I love science so much. However, it has also been valuable to reflect on the sometimes more important non-academic areas of science education. “

“The pupil panel was particularly thought-provoking for making me reflect on why we teach and what impact it can have on the entire lives of students, consequently how important it is that I get it right.”

“I think it has invigorated my love for the subject and given me the impetus to extend my own subject knowledge. I will try to build into my teaching the relevance of the science they are learning by linking it to current research and possible careers to ensure they know the reasons for learning the topic areas. I will also implement a programme to improve the subject knowledge of staff within school.”

“It has made me feel more valued as a professional.”

“Having the pleasure to watch such inspiring up to date lectures has served as a reminder of why teaching science is so important. We are producing the scientists of the future.”