



Mathematics and Science Residential NOVEMBER 2013 CREWE HALL CHESHIRE



The enthusiastic involvement of so many teachers, and the resulting benefit to so many pupils since my first Education Summer School eleven years ago, have given me a great deal of pleasure and satisfaction. The continuing demand for the distinctive, subject-based professional development offered by my Institute means that this is the fifth such course run for Science teachers and the fourth for mathematicians. Some indication of what they have found particularly valuable is provided by these two quotations from delegates who attended the last Science and Maths Residential, held in Cambridge in March 2012:

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

"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."

One feature of these courses is that they give teachers the time and encouragement to think about *why* their subjects should be taught. Of course the What? and the How? questions have to be addressed too. There is material for pupils to learn and understand and a need to find the best means of engaging their interest and attention so that they do so effectively. But, ultimately, the purpose is to give them a better and more sympathetic understanding of the world in which we live and of the patterns and principles that determine our existence. A proper scientific and mathematical education can offer immense help in providing access to crucial aspects of 'Man's accumulated knowledge and wisdom about life on Earth, as well as providing clues to its future development.

So the responsibility that you bear, as teachers of these subjects, is considerable. I can only say thank you for all your efforts on behalf of our children and I do hope that this course will give you some help, guidance and reassurance in your vital task.

thony



WELCOME FROM THE COURSE DIRECTOR

I am delighted to welcome you to this Prince's Teaching Institute Residential. Every year since the first pilot in 2002, these courses have provided an opportunity for teachers to stand back and reflect on the nature of their subjects, on what is most important in the teaching of them, and how they can improve their teaching so as to inspire the next generation of schoolchildren. The teachers themselves tell us that such opportunities are rare in their professional lives and all the more welcome for that.

The PTI courses place an emphasis on academic content and offer a chance to discuss subject issues in depth with academics and experts. Accordingly we have included in this year's programme a number of seminars, presentations and lectures by speakers eminent in their various fields. We are most grateful to them for agreeing to come and delighted to have them with us.

In the workshop sessions our aim is to offer teachers a chance to discuss their work with colleagues and to explore some of the more difficult aspects of subject delivery: what parts of our subject should we be teaching and why, and what are the best ways of doing so? To ensure that these discussions do not remain just at the theoretical level but lead to effective action in the classroom, we shall be introducing you to the PTI Schools Programme, which is designed to ensure that your departmental planning is centred on inspiration and enrichment.

At the end of every residential course we have presented our findings to a panel of educationalists from a variety of backgrounds. This provides an opportunity not only for them to hear what the teachers are thinking, but also for delegates from different disciplines to listen to each other and perhaps find the reassurance of common ground. We do hope that this session will generate an active debate about aspects of education in your subject that concern you; even indeed a consensus that we can then feed through to the policy makers.

But the most powerful effect of the PTI courses to date has been that teachers have gone back to their schools feeling it is within their power to change their classroom approach; to put scholarship and a delight in their subjects at the heart of their teaching. For example, one teacher writes, *"This course has given me back my belief in myself and reawakened my passion for my subject. It has also taught me that I am empowered and that I can."*

I look forward to meeting you all. We have designed a course that I am sure you will find both stimulating and challenging and I hope you will return to your classrooms inspired to share your experiences with your pupils and your colleagues.

Remote Accale

Bernice McCabe Course Director

November 2013



COURSE BACKGROUND

The Prince of Wales's long standing concern about the teaching of English Literature and History was the driving force behind the creation of his first Education Summer School in 2002. Its principal aim was to inspire, invigorate and empower teachers of those subjects. The evident success of the initiative led to the Summer School becoming an annual event, and after five years sufficient momentum had built up to justify expansion. The Prince's Teaching Institute came into being, and with it the Schools Programme, which encouraged more challenging departmental objectives. In succeeding years additional subject streams were created: Science in 2007, Geography a year later, Mathematics in 2009, Modern Foreign Languages in 2011, and Music and Art in 2012. This summer Latin was added to the language stream, marking the PTI's first engagement with the world of classical antiquity.

KNOWLEDGE AND SKILLS

Now entering their twelfth year, these short but intensive courses have provided teachers from all over the country with, to use their words, *'lifeenhancing'* and *'inspirational'* opportunities to discuss their subjects with professional colleagues, leading academics, and those concerned with directing national education policy. The discussions in previous Summer Schools and Residentials have focused on the educational importance of particular subjects: the aspects of them that could or should be taught at different levels, and the best ways for teachers to meet the challenge of doing so effectively.

One of the abiding tensions in education is that between the teaching of knowledge and the teaching of skills. Employers tend to stress the importance of acquiring skills and competences, whereas academics are often more interested in the transmission of knowledge. There is of course a balance to be struck and the two should be complementary. The exact balancing point is likely to vary according to particular circumstances and conditions.

The PTI considers subject knowledge to be of fundamental importance. Skills cannot be taught in a vacuum, and without knowledge there can be no understanding of the concepts which are the building blocks of mental development. Furthermore, we are part of a cultural continuum. Each generation has to build upon what has been learnt, achieved and handed down by previous generations.

This view of education is reflected in the revised framework of the National Curriculum published after consultation in July of this year. Its principal aim is stated thus: "The National Curriculum provides pupils with an introduction to the core knowledge that they need to be educated citizens. It introduces pupils to the best that has been thought and said, and helps engender an appreciation of human creativity and achievement."







MATHEMATICS AND SCIENCE

No-one who has spent any time in a classroom will undervalue the importance of knowing how to teach, as well as what should be taught. But by concentrating on the methodology of teaching and assessment we can lose sight of the simple truth that good teaching is about communicating with enthusiasm and passion what lies at the heart of our subjects. Science encompasses a wealth of world-changing discoveries and insights, to which every child is entitled to be introduced. Teachers of Science must also be able to provide the detailed and up-to-date knowledge of the subject on which further scientific progress essentially depends. Scientific study requires too a knowledge of Mathematics and there is concern among scientific bodies about the inability of even the most promising pupils to perform simple numerical manipulations in handling Science questions.

Mathematics is of course an important and endlessly fascinating subject in its own right, with applications ranging from the routine and practical to the highest levels of abstract thought. It also presents a wide range of challenges for the teacher, when some pupils struggle with simple computations and others seem to have an instinctive understanding of every new topic. Teachers have to find ways to excite the interest of all their pupils and give them the undoubted satisfaction to be derived from mastering an application or solving a problem, whatever the level.

CURRICULAR DEBATE

Science and Mathematics are both core subjects, compulsory elements in the curriculum up to the end of Key Stage 4, and possibly further in Mathematics. This presents the challenge of reconciling the needs of the many and the few: ensuring that all pupils are given the basic knowledge and competence in Science and Mathematics to equip them for an informed and successful life in modern society, while at the same time fostering the commitment of those who can and wish to take their studies in these areas further, not least to maintain the supply of specialists who are so important for the country's economic development. There is scope for a stimulating exchange of ideas about how the best balance is to be achieved.

The consultation period for the revised framework of the National Curriculum may now have come to an end, but this does not mean the end of curricular debate for the time being. Teachers will still want to discuss the best ways of delivering their subjects. The framework document reminds us in its second stated aim that *"The National Curriculum is just one element in the education of every child. There is time and space... to range beyond the National Curriculum specifications."* This is an important educational principle, but how are these spaces to be filled?

EXAMINATION AND ASSESSMENT

Examination and assessment are essential elements in any formal process of education, and they should also encourage good learning. However, there has been a widespread and strongly held belief amongst teachers who have attended previous PTI courses that there should be more incentive for teachers to try to develop in their pupils a full appreciation of the richness of their subject and a closer correlation between the aspirational value of that subject and the way it is examined. Teachers should never feel they have to inhibit their teaching because of testing requirements, but there is little doubt that the combination of league tables and commercially competing exam boards has tended to encourage teaching to the test and the choice of subjects that are perceived as easier. While this may have been aimed at improving test results, it will have had a distorting effect on the education of some children, leaving them unprepared for Higher Education and employment.

Finding the right solution to this problem is a major challenge. The withdrawal of proposals to replace GCSEs in core subjects with a new English Baccalaureate Certificate leaves the debate very much open still. The Chairman of the Parliamentary Education Select Committee has, quite properly, said that "no sensible reform of assessment can take place without clarity as to what is to be taught". In other words, curricular reform has to be agreed before decisions are made about how it will be examined. That is an encouragement to our delegates here to consider the two things together.



OUR AIMS

The Prince's Teaching Institute believes that all pupils, irrespective of background or ability, are entitled to be taught by passionate and knowledgeable teachers. It was created in 2006, and works in partnership with the University of Cambridge. The PTI has grown out of The Prince of Wales Education Summer Schools which, every year since 2002, have provided an opportunity for teachers to come together to debate, and where necessary challenge, teaching approaches to their subject. Its aims are to:

- Promote the idea that subject knowledge, subject rigour and the enthusiasm for communicating them are essential requirements for effective teaching to children of all abilities;
- Create an inspirational forum for teachers, enabling them to step away from the classroom and rediscover their love of their subject;
- Promote and provide subject-based Continuing Professional Development for teachers;
- Encourage and inspire teachers by demonstrating good use of academic rigour and challenge in the classroom;
- Create stronger links between academic departments in schools and universities;
- Promote and enable a more constructive dialogue between teachers and government educational agencies on issues relating to curriculum development, assessment and training;
- Promote the establishment of a national body, independent of government, that will enhance effective subject teaching and uphold teachers' professional standards.

The Prince's Teaching Institute brings together teachers and leading academics with a view to encouraging rigorous and challenging subject teaching in all schools for children of all abilities. It demonstrates how children can be inspired, and consequently achieve higher standards, by teaching that goes beyond the constraints of exam syllabuses and by rich subject provision that incorporates extra-curricular activities. It also provides an additional pathway of communication between teachers, Higher Education and government agencies.

'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'

'I will return to my school with rekindled passion for my subject and refreshed empathy for my students.' '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.'

Quotes from Maths and Science Residential 2012 and from 2013 Summer School delegates



The Aims

The aim of the course is to explore the nature and purposes of Mathematics and Science teaching, specifically by:

MATHEMATICS

- Providing an inspirational forum to discuss the central role and enabling nature of Mathematics within the school curriculum;
- Promoting an understanding of the nature and scope of Mathematics, and of the combination of comprehension, technical expertise, logic and rigour of practising mathematicians;
- Developing approaches that will equip pupils with the confidence to acquire and apply the mathematical knowledge and skills required in our increasingly complex and demanding society;
- Discussing and focusing upon the aspects of Mathematics that stretch and challenge pupils of all abilities;
- Developing expertise and facilitating the sharing of good practice in the teaching of Mathematics.

SCIENCE

- Providing an opportunity for leading teachers to consider the reasons for Science being a core subject in today's world and the place of values within Science education, thus enabling pupils to make informed judgements about the implications of scientific developments;
- Offering a forum for the debate of these issues, with eminent scientists and leading science communicators and educators presenting some challenging perspectives of their own;
- Providing an opportunity for leading teachers to explore the principles of rigorous, relevant and responsible Science teaching to pupils of all abilities, through participation in workshops led by experienced teachers;
- Probing critically current approaches to Science education and its assessment, and examining the extent to which young people are being equipped to understand the nature and importance of scientific thinking;
- Encouraging leading teachers to reflect on the overall provision of the Science programme in their schools and to plan for challenging and focused developments that will contribute to improving engagement and raising standards of achievement in the Sciences.



The Objectives

To consider further questions of educational principle and practice, and in particular to:

MATHEMATICS

- Promote self-confidence in teachers by sharing and refining ideas for developing the Mathematics programme at their schools in ways that are flexible but rigorous, and creative but sustainable;
- Consider various applications of Mathematics, and how it can be used to model outcomes in real life scenarios;
- Look at the links between Mathematics and other subjects, for example Engineering and Art;
- Promote greater challenge for both teachers and pupils in the classroom and give pupils a better understanding of mathematical reasoning.

SCIENCE

- Refresh the thinking of teachers about the role of Science in preparing both responsible citizens and specialist scientists for the future;
- Share and refine ideas for rigorous, exciting and sustainable developments in the Science programme in delegates' schools;
- Learn about some current lines of scientific research and relevant examples of how ideas explored in the school Science curriculum may have real applications in the world beyond school;
- Consider how to strengthen and extend scientific understanding and participation through the creative and engaging use of practical and experimental work;
- Discuss the impact of national policies and practices on the effectiveness of Science teaching and consider ways forward for improvement.

Programme

ТІМЕ	SCIENCE	MATHEMATICS
0900-1030	Registration	
1030-1050	Course Welcome by Course Director	
1050-1140	Pupil Panel - Mathematics and Science	
1140-1210	Break	
1210-1300	Keynote Adress Professor Heinz Wolff Hand, eye and brain, over and over and over again; the virtuous circle	
1300-1400	Lunch	
1400-1530	Group Workshop 1 Why do we teach Science?	Group Workshop 1 Why do we teach Mathematics and what are the issues in Mathematics education?
1530-1600	Break	
1600-1700	Choice of Lecture Dr Amoret Whitaker Fly on the wall: The use of insects in forensics Dr Rob Mulvaney OBE Frozen in time: The archive of past climate and atmospheric change	Lecture Professor Marcus du Sautoy OBE The Num8er My5teries
1700-1830	Group Workshop 2 Sharing good practice	Group Workshop 2 Sharing good practice
1830-1930	Break	

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TIME	SCIENCE	MATHEMATICS	
0900-0915	Schools Programme Overview		
0915-1015	Lecture Professor Sir John Holman What really matters in secondary Science education?	Lecture Peter Ransom New lamps for old	
1015-1130	Group Workshop 3 Exploring current issues in Science education (including break)	1015-1030Break1030-1130 Choice of LectureGarrod MustoSTEM initiatives in schools, developing opportunities for Mathematics teachers to work across multiple departments in a meaningful wayDr MathsWhat's luck got to do with it? Creating mathematical ownership in the classroom. Number patterns, probability and mathematical gamesTom BreeThe beauty of visual Mathematics	
1130-1200	Science Plenary	1130-1145 Break	
1200-1300	Choice of Lecture Professor Anne Ridley Cancer cells on the move Dr Andrew Steele Superconductivity: How to engineer flying trains and bottled stars	1145-1300 Group Workshop 3 Beyond the curriculum: Making Mathematics engaging for all, how can we overcome the difficulties that occur when teaching Mathematics?	
1300-1400	Lunch		
1400-1500	Choice of Lecture Professor Innes Cuthill Animal camouflage: Evolutionary Biology meets neuroscience, art and war Professor Duncan Wass Towards sustainable petrochemicals: Catalysis is the key Dr Hannah Fry Is life really that complex?	 Choice of Lecture Dr Maths What's luck got to do with it? Creating matematical ownership in the classroom. Number patterns, probability and mathematical games Garrod Musto STEM initiatives in schools, developing opportunities for Mathematics teachers to work across multiple departments in a meaningful way Dr Hannah Fry Is life really that complex? 	
1500-1700	Group Workshop 4 Sharing development objectives (including break)	1500-1530Break1530-1700 Group Workshop 4 Sharing development objectives	
1700-1800	Choice of Lecture Dr Rupert Sheldrake Freeing the spirit of enquiry Dr Anita Wale Teaching the Biology and Physics of radiology – density, echoes and cancer	Lecture Charlie Stripp Curriculum changes in Mathematics and their implications for classroom teachers	
1800-1930	Break		
1930	Reception and Dinner After dinner talk by Richard Noble OBE		

TIME	SCIENCE	MATHEMATICS		
0900-1030	Workshop 5 Creative thinking in Key Stage 3	Workshop 5 Charlie Gilderdale eNRICHing students' mathematical experience		
1030-1100	Break			
1100-1230	Workshop 5 Creative thinking in Key Stage 3 (cont.)	1100-1130 Break 1130-1230 Workshop 5 Charlie Gilderdale eNRICHing students' mathematical experience (cont.)		
1230-1330	Lu	nch		
1330-1530	Report back on key themes Plenary discussion with panel of educationalists			
1530-1545	Evaluations			
1545	De	part		

'I now realise that empowerment and nurturing my needs are essential to enable me to share my passion with my students. Thank you for the opportunity of caring for my personal learning, being able to nurture my own curiosity again. It's 20+ years since I was encouraged to do so, so positively.'

Quote from 2012 Residential delegate

KEYNOTE SPEAKER



Professor Heinz S. Wolff

Professor Heinz Wolff graduated in Physiology and Physics and was probably the first individual to call himself a "Bioengineer". He has worked as the Director of Bioengineering Divisions, for the Mediacl Research Council (MRC), at both the National Institute for Medical Research, and the Clinical Research Centre. He also served as the Chairman of a variety of committees at the European Space Agency. In 1983 he founded the self-financing Institute for Bioengineering at Brunel University, which he directed until 1995. He is now 85.

He leads a double life, sharing his professorial duties with those of a scientific educator and entertainer, on radio and television presenting programmes such as *The Great Egg Race*, and as a prolific lecturer. He is now Emeritus Professor of Bioengineering, leading a team concerned with innovation, which will have an impact on major social problems. Ensuring a good quality of life for the increasing number of frail elderly people is his priority, and he has undergone an interesting change of attitude. After nearly 60 years of designing technological equipment, he has come to the conclusion that further technological development is unlikely to make a major contribution to care and support and the recruitment of part time carers should be the goal of the community.

AFTER DINNER SPEAKERS



SATURDAY

Professor Marcus du Sautoy OBE

Professor Marcus du Sautoy is a Professor of Mathematics at the University of Oxford. His academic work concerns mainly group theory and number theory. In October 2008, he was appointed to the Simonyi Professorship for the Public Understanding of Science, succeeding Richard Dawkins. In 2001 Professor du Sautoy won the Berwick Prize of the London Mathematical Society, which is awarded every two years to reward the best mathematical research by a mathematician under forty. He writes for *The Times* and *The Guardian* and appears regularly on television and radio. He presented the 2008 BBC TV series *The Story of Maths*, which examines the development of key mathematical ideas and shows how mathematical ideas underpin the science, technology, and culture that shape our world.

Professor du Sautoy is a PTI Ambassador, and he delivered a lecture on the History of Mathematics at our first one-day CPD event for Mathematics teachers in March 2010. He also gave a talk for teachers and their students as part of the PTI's Summer School Lecture Series in July 2012.



SUNDAY

Richard Noble OBE

Against a background of today's low risk culture, Richard Noble specialises in developing high risk ventures. Perhaps best known have been the Thrust2 programme, which brought the World Land Speed Record back to Britain in 1983, and the Thrust SSC, the first ever supersonic land speed record programme. His other projects include the ARV Super2 light aircraft, the Atlantic Sprinter Blue Riband contender, Farnborough Aircraft, the first distributed travel air taxi aircraft, and currently the Mach 1.4 Bloodhound SSC project, the latest in the long line of Land Speed Record cars now being run through 3600 UK schools.

The projects have always tended to be innovative, putting them against the odds and against a system which will always favour the conventional. As a conference and after-dinner speaker, Richard Noble explains the huge problems in trying to persuade the old British establishment to consider and implement change, and listen to original thinking.

PANELISTS



Yvonne Baker

Yvonne Baker has been CEO of Myscience and Director of the National Science Learning Centre since October 2010. Myscience operates the national network of Science Learning Centres which provide inspirational and innovative professional development for Science teachers, technicians, lecturers and teaching assistants from across the UK. Previously she was Chief Executive of STEMNET, an organisation that creates opportunities to inspire young people in STEM. She is a Chartered Chemical Engineer, a Fellow of the Royal Society of Arts and a member of the Institute of Directors. She is also a member of the Engineering Council Board. She passionately believes that STEM subjects can give all young people access to essential subject, employability & life skills, so offering them great opportunities for exciting and fulfilling working lives.



Matthew Harrison

Matthew Harrison is Director of Engineering and Education at the Royal Academy of Engineering. Founded in 1976, The Royal Academy of Engineering promotes the engineering and technological welfare of the country, focusing on the relationships between engineering, technology, and the quality of life. He is a Chartered Engineer, an Engineering teacher and academic, and an experienced leader of 14-19 STEM education. He maintains a postgraduate teaching and student supervision post at Cranfield University and is a Visiting Professor at the Institute of Education in London. He is a regular commentator on STEM education in the media and an advisor to government on STEM education.



Charlie Stripp

Charlie Stripp became Chief Executive of Mathematics in Education and Industry (MEI) in 2010 and Director of the National Centre for Excellence in the Teaching of Mathematics (NCETM) in March 2013. Through his work with MEI, he has developed extensive experience in curriculum development and assessment in Mathematics at secondary level. He has been an active member of the Mathematical Association for over 20 years and currently serves on the MA's Council. He taught Mathematics in the state sector for 10 years, both in school and in an FE college. He has taught trainee teachers and delivered numerous professional development courses for secondary and sixth form Mathematics teachers. He has been a regular presenter at national Mathematics education conferences for the past 15 years.



Dr John Wm Stephens

Dr John Wm Stephens joined the National College as Director for School Improvement in February 2012, and is now leading on teaching schools and system leadership in the new National College for Teaching and Leadership. Dr Stephens is a trustee of two charities working in support of people with disabilities and he has a regional role in safeguarding for a national charity. He previously worked as a teacher in rural Leicestershire and in Manchester. He has been a Headteacher in urban schools and has led on school improvement in a local authority. He also served as Director of Children's Services helping to set up a newly established local authority.



Keeping in Touch

SCHOOLS PROGRAMME

As you have attended this Residential, your department is eligible to join The Prince's Teaching Institute Schools Programme.

The Schools Programme is a membership scheme that gives you the opportunity to stay in touch with teachers you have met and allows you to continue to promote the spirit of the Residential once back at school. Members share ideas and projects that enhance their department's subject provision, and meet every year to share experiences and devise further ideas.

Membership gives all members of your department access to the resources of the Staffroom area of the PTI website, discounts on Continuing Professional Development courses and, after a year, the opportunity to use the PTI Mark on your school's stationery and website (above).

Membership is obtained by discussing and agreeing your departmental objectives with your Teacher Leader, and requires the agreement of your school's Head and Chair of Governors.

For further details please talk to any member of the PTI team at the Residential, or email Alice Arkwright: alice.arkwright@princes-ti.org.uk

CONTINUING PROFESSIONAL DEVELOPMENT

The Prince's Teaching Institute provides one-day subject-based Continuing Professional Development courses. Combining academic lectures and teacher workshops, the courses are similar to a day of the Residential, but are usually focused on a particular area of the curriculum. The days are devised and led by practicing teachers, and the PTI office provides all logistical support and will invite speakers.

Past speakers include David McKay, Chief Scientific Advisor to the Department of Energy and Climate Change, Dr Kevin Fong, Co-director of the Centre for Aviation Space and Extreme Environment Medicine, Dr James Grime of The Enigma Project and Dr Vinay Kathotia of The Nuffield Foundation. Details of forthcoming events can be found at: **www.princes-ti.org.uk/events**

We welcome offers to run CPD events. If you are interested, please email Sarah Darrall Shaw: **sarah.darrallshaw@princes-ti.org.uk** or Guy Norton: **guy.norton@princes-ti.org.uk**

WEBSITE

The public pages of **www.princes-ti.org.uk** contain details of all of our activities and events. Membership of the Schools Programme allows you to access the Staffroom area of the website and its expanding library of resources. As well as the opportunity to listen again to many of the lectures from this Residential, you will be able to hear podcasts of speakers from previous PTI events, and access a wealth of presentation materials and teaching resources. Should your department join the PTI Schools Programme, all members of your department will gain access to these resources.



Thank you to Our Patrons

The Prince's Teaching Institute would like to thank members of the 2012 Club and Patrons listed below, and a number of anonymous donors, who have committed multi-year financial support to the charity.

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Department for Education

MAYOR OF LONDON



BERNICE MCCABE Course Director

Headmistress, North London Collegiate School, and Co-Director, The Prince's Teaching Institute

A Head for over 20 years, Bernice McCabe studied English at Bristol University and has an MBA. She taught for 16 years in mixed comprehensives in Bristol and London, including 5 years as Head of English and 4 years as Deputy Head of The Heathland School, London Borough of Hounslow. Since 1990 she has been a Headmistress: for 7 years of Chelmsford County High School, a maintained grammar school, and since 1997 of North London Collegiate School, a 4-18 independent school, which opened its first overseas campus on the island of Jeju in South Korea in September 2011.

She has served on national education committees in the maintained and independent sectors. Since 2010 she has been a member of the National Curriculum Review Advisory Committee and in February 2013 she was appointed as an Expert Advisor for the London Schools Excellence Fund, set up by the Mayor of London to promote excellent teaching and help tackle underperformance in London maintained schools.

In 2002 she directed the first Prince of Wales Education Summer School. In 2006 the annual Summer Schools grew into The Prince's Teaching Institute (PTI) which she now Co-Directs.

ACKNOWLEDGEMENTS

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Mathematics and Science Residential

NOVEMBER 2013 CREWE HALL CHESHIRE

