

**Impact case study (REF3b)**

<p><b>Institution:</b> University of Leicester</p>
<p><b>Unit of Assessment:</b> UoA25 Education</p>
<p><b>Title of case study:</b> Impact on Continuing Professional Development for Science Educators</p>
<p><b>1. Summary of the impact</b></p> <p>The need to produce more science graduates to meet the ambitions of a knowledge-based economy has been recognised in several UK Government initiatives, yet despite the growth in University admissions since 1986 the percentage of students studying science has fallen. Research led by Tina Jarvis has had significant impact on the development of effective science CPD, designed to address the problem that many primary school teachers lack competence and confidence in science teaching. This research has underpinned the establishment of two CPD Centres, which have provided CPD for over 7,300 teachers, technicians and teaching assistants in the UK during the assessment period and a range of projects which have achieved sustained impact on teachers’ practice and pupils’ learning and engagement, regionally, nationally and across Europe, involving over 30 partners across 23 countries.</p> <p><b>2. Underpinning research</b></p> <p>Science education in the UK and Europe has been the focus of considerable attention because of the declining numbers of young people choosing to study or pursue careers in science. This poses a threat to the Lisbon agenda which seeks to place the EU at the forefront of the knowledge economy of the future. All students, including future scientists, need to be educated to be critical consumers of scientific knowledge, improving the public’s ability to engage with socio-scientific issues such as climate change. The UK government’s economic strategy sets out to increase the number of science graduates and to promote public understanding of science.</p> <p>A programme of research at Leicester over more than 10 years has explored the design of science CPD, using an inquiry-based approach, informed by the development of instruments to measure improvement in teachers’ competence and attitudes towards science, and the impact this can have on pupils’ attitudes and learning. Choices about future study and careers are strongly influenced by children’s attitudes towards curriculum subjects which start in the primary school, where the need to support teachers’ expertise is most acute.</p> <p>In the 1990s Tina Jarvis, who was appointed as a lecturer in the School of Education in 1989 and was promoted to Professor before her retirement in 2013, began to research the relationships between teachers’ and pupils’ attitudes towards, and understanding of, science. Funding from the AstraZeneca Science Teaching Trust (1998-2000) supported a project involving 70 teachers and 2,000 pupils in 31 primary schools. Supported by colleagues at Leicester (Frankie McKeon (Lecturer, 1996 onwards), Dr Tony Pell (Research Assistant 1996-2009)), Jarvis developed four instruments to measure changes in pupils’ and teachers’ attitudes and understanding which were used to monitor the effectiveness of the CPD programme (1, 2). In addition to the positive impact of the inquiry-based approach on teachers’ understanding and pupils’ learning, relationships were found between science understanding and attitudes towards science in both teachers and pupils (3,4,5). These results informed further development of the design of science CPD, and formed the basis for further research.</p> <p>An extension of the research was through projects undertaken in collaboration with the National Space Centre (6). In 2000, Jarvis and Pell surveyed 650 children who visited the NSC, using the instruments developed in the AstraZeneca project, to monitor changes in their attitudes before and after the visit, and explore the particular features of the experience at NSC which had contributed to this. Findings highlighted the key role of teachers in preparing children for the visits and providing follow-up work to sustain gains in children’s attitudes to science.</p> <p>A final significant study conducted by Jarvis, Pell and Hingley (Research Assistant) drew on data</p>

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from the studies described above, plus the evaluation of the EU Pollen Project (described in section 4) to develop a model of science teachers' CPD needs which has informed the design of subsequent provision (6).

**3. References to the research**

1. Pell A. & Jarvis T. (2001) Developing attitude to science scales for use with children of ages from five to eleven years *International Journal in Science Education*, 23(8) pp 847-862.
2. Pell A. & Jarvis T. (2003) Developing attitude to science scales for use with primary teachers *International Journal of Science Education*, 25(10), pp 1273-1295.
3. Jarvis T., Pell A., McKeon F. (2003) Changes in primary teachers' science knowledge and understanding during a two year in-service programme *Research in Science & Technological Education*, 21(1) pp 17-42.
4. Jarvis T. and Pell A. (2005) The Relationships between Primary Teachers' Attitudes and Cognition during a Two Year Science In-service Programme, in K.Boersma, M. Goedhart, O. de Jong and H. Eijkelhof (eds) *Research and The Quality of Science Education*. Springer (pp 157-168).
5. Jarvis T. and Pell A. (2005) Factors influencing elementary school children's attitudes to science before, during and following a visit to the UK National Space Centre *Journal of Research in Science Teaching*, 42(1) pp 53-83.
6. Jarvis, T., Pell, A. and Hingley, P. (2011) Variations in primary teachers' responses during three major science in- service programmes. *Center for Education Policy Studies Journal*; 1,(1),67-92

**Funded Projects**

Pollen Seed Cities for Europe: A Community Approach for Sustainable Growth of Science Education in Europe (2006-09) *EU Framework 6 (budget to Leicester €159,705)*

Fibonacci: Disseminating Inquiry-Based Science & Mathematics Education in Europe (2010-2013) *EU Framework 7 (budget to Leicester €356,952)*

**4. Details of the impact**

Impact within the assessment period builds on a longer history of engagement with science teachers, which began with the establishment of the SCICentre, funded by the Society for Chemical Industries, in 1996. The Centre produced a range of print and video materials, underpinned by research findings, which focussed on improving subject knowledge and teaching practice, promoting positive images of scientists and their work in industry, and supporting the use of IT in science teaching. Materials were distributed to UK ITE providers, and were available for sale nationally and internationally, the most substantial numbers being bought in USA, Australia, New Zealand, Malta and Ireland. Video materials were made available on YouTube in 2010 (<http://www.youtube.com/watch?v=Kz2c5OJ5Yx0>).

The research programme led by Jarvis established the reputation of Leicester School of Education in the field of science education, and was a significant factor in the award to the School of the competitive contract to establish the Science Learning Centre East Midlands (SLCEM) in 2004. As part of the Government-funded national network of 10 Science Learning Centres, SLCEM is the major provider of science CPD in the region and has a close relationship with the School of Education. This enables research carried out in the School to inform the content and direction of the science CPD SLCEM provides. In return, SLCEM provides a testing and validation

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environment for the School's cutting-edge research. Impact and evaluation studies from the SLCEM are shared with the national network of Science Learning Centres in order to inform future development. Since being awarded the initial contract in 2004 and the second in 2008 with further extensions in 2011 and 2012, SLCEM has provided CPD for over 10,000 teachers (7300 teachers from 2008 to present, **A**), technicians and teaching assistants and the impact during this period in the region has been considerable. In the period since 2008:

- 75% of participants reported improvement in their knowledge and skills
- 81% reported changes in their practice
- 75% reported evidence of wider impact on the school
- 67% demonstrated impact on pupils in terms of learning, motivation and enjoyment
- 71% of participants indicated that the greatest impact had been on the sharing of knowledge with colleagues
- 79% of participants reported an impact on their skills in teaching in terms of science knowledge and understanding.

Evaluation studies also indicate that 99% of teachers attending would recommend SLCEM CPD courses to others and 97% rated these as being very good or good (**A**).

In addition to this considerable influence within the UK context, the impact of development of science CPD built on and informed by Jarvis' research has spread in Europe through two major EU funded research and professional development networks. Pollen Seed Cities for Europe (2006-09) involved 12 countries, in each of which a 'Seed City' was identified to develop inquiry-based science in primary schools. The team at Leicester worked with 95 teachers and 2500 pupils in 27 schools, and took the lead in developing innovative cross-curricular approaches to science teaching which were disseminated across the project. Additionally, at the conclusion of the project, University of Leicester was commissioned to evaluate the effects in all 12 countries, using the instruments developed in the AstraZeneca project. Responses from 420 teachers indicated the positive impact: *'After two years, the confidence of teachers teaching science had improved significantly and that attitudes to specific Pollen objectives have shown significant improvements'* (**C**).

The particular success of the Pollen project was identified in the EU commissioned Rocard Report (**B**): *The specificity of Pollen ... [is to] promote a change in the pedagogical approach used to teach science. Additionally these initiatives provide opportunities for the establishment of a European network of science education teachers, which appears to be a key factor in promoting excellence.*

The success of Pollen's impact on teachers' confidence and competence in teaching science formed the basis for the development of a larger cross-European network, through the Fibonacci project (2010-2013; **D**), which had the aim of disseminating Inquiry-Based Science & Mathematics Education in Europe. The project involved over 30 partners across 23 countries involving at least 6000 teachers and 30000 pupils, and 500 teacher educators. Leicester was one of the major partners, considered to have special expertise in science CPD, and also led a cross-curricular thematic group, involving teams from seven countries.

The project evaluation (**E**) reported that: *'.. there has been a clear impact on the schools, the teachers and the pupils as shown by the analysis of the statistical data gathered. Teachers state that their motivation and confidence in teaching IBSME has been greatly enhanced by the CPD organized by Fibonacci. When analysing the difference between the average confidence scores of all the teachers in the pre-and post- questionnaires there is a significant positive difference on two thirds of the items surveyed especially when aspects of inquiry-based teaching are concerned.'*

**5. Sources to corroborate the impact**

A. SLCEM Evaluation data and Impact Reports (part of termly report to funders) Summer '11, Autumn '11, Spring '12, Summer '12.

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B. Rocard report 'Science Education Now: A renewed pedagogy for the future of Europe'.  
([http://ec.europa.eu/research/science-society/document\\_library/pdf\\_06/report-rocard-on-science-education\\_en.pdf](http://ec.europa.eu/research/science-society/document_library/pdf_06/report-rocard-on-science-education_en.pdf))

C. Final Report Summary - POLLEN (Seed cities for science, a community approach for a sustainable growth of science education in Europe)  
([http://cordis.europa.eu/search/index.cfm?fuseaction=result.document&RS\\_LANG=EN&RS\\_RCN=12906117&q=](http://cordis.europa.eu/search/index.cfm?fuseaction=result.document&RS_LANG=EN&RS_RCN=12906117&q=))

D. Fibonacci project website: Fifth Newsletter (<http://www.fibonacci-project.eu/>)

E. Fibonacci evaluation report (Edu.Consult) (2013)