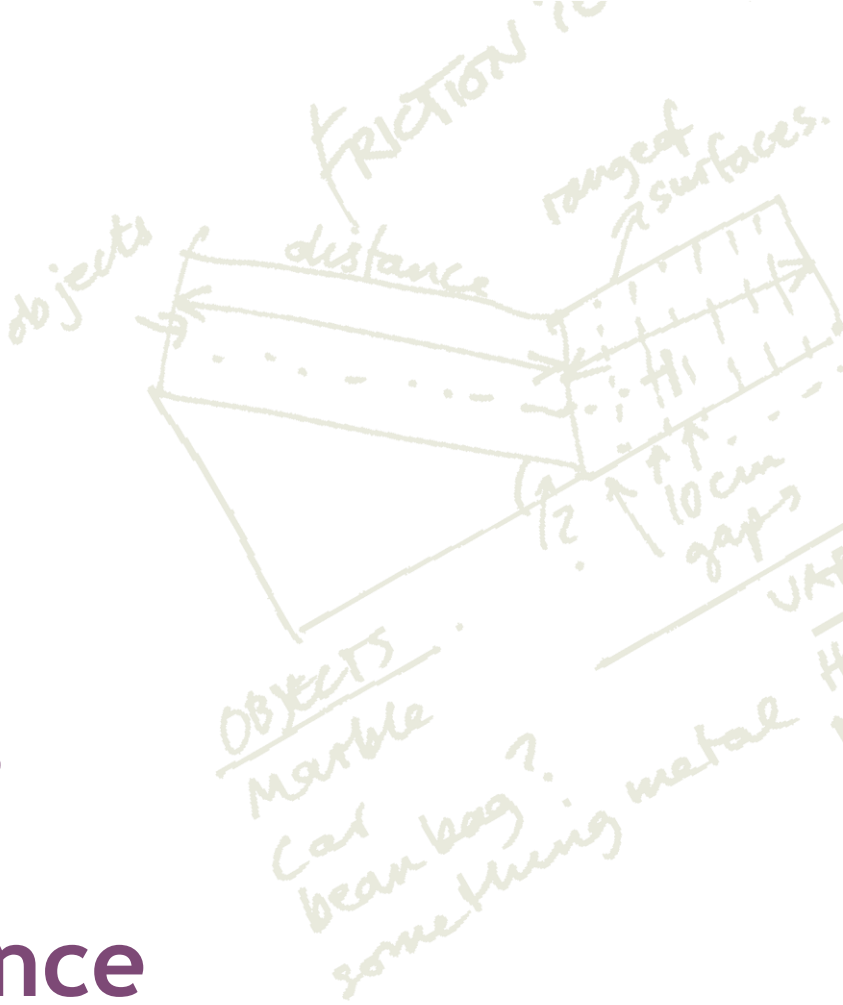
CREATIVITY MATTERS03



Making space for teaching creative science

Tim Caulton

CREATIVE
INNOVATIVE
SUPPORTIVE

IVE Creativity Matters

Creativity is an essential human attribute which should lie at the heart of learning.
The ability to face uncertainty and respond to complex challenges with energy, enthusiasm, imagination and resourcefulness has never been more important. We believe that children and young people have a right to experience and develop their own creativity – becoming proactive, creative players in the world.

Through the 'Creativity Matters' series we are hoping to stimulate a conversation about how we can transform the experiences which children and young people have in their schools and communities to make this right a reality.

We want to open up a discussion about some key questions which have emerged from our work in promoting creative teaching and learning. All of the issues will draw on IVE's experience in this field. Some of the issues will be provocative - challenging prevailing assumptions; others will raise questions in a more tentative way. However, all are intended as a stimulus to further debate and discussion in order to grow our understanding of children and young people, learning and creativity.

If you would like to carry on the conversation please contact us at: hello@weareIVE.org

Making space for teaching creative science

Notes & Remarks
Jot down your thoughts in the margin here...

Changes to the science curriculum at GCSE Level from 2006 are designed to engage future non-scientists with scientific issues and approaches as well as to improve the education of future scientists. These changes have the potential to make science a more popular curriculum choice. But will they be enough by themselves? This article considers some recent approaches which open up science learning to a more creative approach, engaging students in experimentation and imaginative and creative problem solving. It explores whether such lively and inspirational approaches can make science more appealing to children, young people and teachers.

My most unforgettable science lesson took place in the late 60s when a hitherto desperately dull Physics teacher encouraged the class to experiment with making highly fashionable lava lamps using aniline and water. Now it could be that the teacher was getting his own back on troublesome pupils by allowing access to a noted carcinogen, but I would rather think he saw a unique opportunity to captivate the class with some intriguing and populist science. For health and safety reasons it is inconceivable that this experiment would take place today, but it is the one science lesson I remember most vividly. It helped stimulate a lifetime interest in experimentation, and a career developing interactive exhibits for museums and science centres.

Many contemporary scientists and engineers will point to a particularly enthusiastic teacher who stimulated their curiosity and encouraged them to experiment as children, or perhaps to an inspirational school visit to a museum, or to a significant scientific discovery. Such interventions can result in a lifelong interest and appreciation of science. The problem in the past was that such experiences were piecemeal, often dependent on the enthusiasm, knowledge and skills of individual teachers. Many children passed through school with only a basic understanding of science and its impact on our lives, a low level of appreciation for the subject, and little ability to think as scientists.

Of course, the National Curriculum, its associated QCA Schemes of Work and the Secondary National Strategy have promoted more equitable teaching and learning in science, and many science teachers have developed excellent teaching skills. However, too many regard the Schemes of Work as a diet to be fed to pupils. Although there are examples of the Strategy promoting more creative approaches, inspirational teachers have been largely reined in, and there is less space for the kind of creativity enjoyed by some - if not the majority - before 1988.

The Roberts Report highlighted the conflict between the growing demand for science graduates and the decreasing number of students choosing to study mathematics, engineering and the physical sciences[1]; for example, there was a 21% fall in the number of students studying A Level Physics in 1999/2000 compared to 1991/2. It emphasised that poor experience of science at school has resulted in a widespread belief that science and engineering are hard to study, uninteresting and irrelevant, and that career prospects are unpromising. At that time, only 5, 6, and 8% of A Level students took physics, chemistry and biology respectively.

According to the extensive pupil review of the Science Curriculum by Planet Science and the Science Museum in 2002/3, students found

Notes & Remarks

[1] SET for Success: the supply of people with science, technology, engineering and mathematics skills, The report of Sir Gareth Roberts' Review, April 2002.

Notes & Remarks

Physics the least enjoyable science subject in school. Learning, it suggested, could be made more relevant and interesting with a slimmer curriculum, less emphasis and value on committing facts to memory, more investigative work, and more opportunities for debating contemporary issues.[2]

Although the need to encourage young people to take up careers in science and technology is nationally recognised, many schoolchildren do not perceive science, and science careers, as exciting, accessible or relevant, and there is a nationally recognised need to stimulate young people to follow science post-16. In addition, whichever careers our young people go on to, they should be engaged with scientific issues which impact on their lives, and be equipped with the thinking, questioning and critical skills to apply to other contexts apart fromscience.

The new curriculum changes are designed to address this issue. But will these alone be enough to engage young students? Many primary age children are enthused by science - we can see it in hands-on science centres every day. Why have they become so disengaged by the end of Key Stage 2 from a subject that should, and could, be at the forefront of stimulating their curiosity? It must be recognised that the current curriculum and science teaching methods do appeal to the learning styles of those children who have a thirst for facts and knowledge, and to many committed and successful teachers, and it is imperative to value and not lose this. (Of course, many of those pupils go on to become science teachers and curriculum advisors etc thereby perpetuating traditional teaching methods.)

It may also be the case that the full range of creative approaches is not understood or recognised by teachers. Such is the pressure on teachers for their pupils to achieve, that lessons have to be planned in the minutest detail, and they feel that there is little room for experimentation. **Where practical demonstrations can be fitted in, there are often so few variables that they are not really experiments in the true sense of the word at all.** The educational system does not encourage teachers to take risks, and until some of the creative elements of science are assessed or accredited by the assessing bodies, any creative science initiatives are likely to be something of a sideshow. Teachers in a successful school may often be reluctant to change for fear of damaging a system that works, whilst teachers in a failing school will not want to take risks unless it can be proven that standards will rise. How can this cycle be broken?

There is no doubt that many science teachers in the UK are highly skilled, and there is a need to harness their skills and enthusiasm so

[2] http://www.planet-science.com

they can convey these to their pupils. Can we free up our teachers so that science teaching is lively, inspirational and creative, and so that they have the time, space and encouragement to explore their subject and share ideas with colleagues? If successful, many more young people will be attracted to science and technology in school and beyond. Teaching science might also have more appeal, attracting and retaining a broader cohort of new teachers. This article attempts to provide some possible solutions.

Concurrent with the implementation of the National Curriculum in UK schools has been the development of the interactive science centre (which first appeared in the UK in 1985), a movement much enhanced in recent years by funding from the Millennium Commission. There is ample evidence from numerous evaluation studies that interactive science centres have a positive influence on attitudes and feelings towards science, although their effect on long-term cognitive understanding is disputed. The accepted explanation of the positive impact on affective learning is that the range of exhibits on offer in an interactive science centre has wider appeal than more traditional classroom learning as the exhibits embrace more varied learning styles.[3]

Alongside the development of the interactive science centres has been a growth of science discovery clubs linked via the SciZmic network.[4] The problem with visits to interactive science centres and with the science discovery clubs is that they are both extra-curricular. Whilst they may well satisfy the needs of those students who wish to explore science outside the classroom, they also highlight the often uninspiring routine teaching of science. **The question is how can we release, maximize and embed creative approaches to teaching science into mainstream teaching and learning, to break down the cycle of disengagement by pupils at Key Stage 3 and beyond?**

The most effective interactive exhibits within a science centre involve open-ended exploration of phenomena within controlled parameters. These are sometimes understandably viewed with suspicion by science teachers in that they encourage students to construct their own understanding, which may well be incorrect in the sense that it differs from accepted scientific knowledge and understanding. The intended role of the teacher, or science centre explainer, is to be an effective mediator of science learning, but clearly this is less controllable in a museum than in a classroom setting.

Exhibits with more didactic learning objectives and closed learning outcomes (akin to classroom teaching) are usually perceived to represent a lost opportunity within the science centre.

Notes & Remarks

[3] T.J.Caulton, Hands-on Exhibitions: managing interactive museums and science centres, Routledge, 1998.

[4] http://www.scizmic.net/

Notes & Remarks

Whatever the impact on learning instigated by interactive exhibits in science centres, what is clear is that the exhibits - however enjoyable - do not engage the visitor in the creative process of development. Their development typically involves the team of scientists, artists, designers and exhibit fabricators in an intense period of creativity. Can this be replicated in the classroom in a way that is not possible in the science centre itself?

There is a long tradition of schools employing creative practitioners to deliver workshops to children. Many of these engage children in the creative exploration of science. For example, the author project-managed the Science Week Challenge: a series of activities for Creative Partnerships within schools in Nottingham during Science Week in 2004.

There is no doubt that these workshops - typically of one day duration - can have a significant short-term impact, appealing to children with different learning styles, and potentially they can have the kind of long-term inspirational impact described above. However, these are usually one-off workshops and have little influence on the wider professional development of teaching staff - although it is acknowledged that there is a cumulative effect on creative practice in schools where creative partnerships operate.

There have been numerous initiatives by Creative Partnerships, NESTA and others in recent years to inject creativity into the school science curriculum. Two recent publications describe some of these activities in some detail. NESTA has published Real Science[5], a report which draws on all of the science learning work with children and young people. Creative Partnerships has compiled a pack which aims to inspire science teachers to adopt more creative approaches to science teaching, and which reviews a number of the initiatives which it has funded.[6]

The author was project supervisor/critical friend to a different NESTA project implemented by CAPEUK (now known as IVE). CAPEUK is committed to exploring innovative approaches to teaching and learning, especially to identify strategies which will develop the creative capacities of children and young people. Its philosophy is based on a recognition that there is considerable evidence that the current education system is not effective in supporting science teachers and young people to develop creative capacities in terms of creative thinking, developing ideas, risk taking, complex problem solving and imagining new ways of approaching issues.

[5] **Real Science - encouraging experimentation and investigation in school science learning, NESTA, November 2005**

[6] **I wonder: a creative science springboard, Creative Partnerships, 2005.**

CAPEUK takes the view that creativity is a way of thinking and behaving that can be nurtured, given:

- Time for play and exploration
- Willingness to value process as well as product
- Access to different kinds of stimulus and expertise
- More open curriculum content
- Opportunities to learn in different settings
- Real-life challenges and models.

NESTA funded CAPEUK, working closely with the Centre for Science Education at Sheffield Hallam University, to run an innovative, experimental project during 2003-5. In Creative Space, science teachers from ten schools in Greater Manchester and Leeds, worked in collaboration with teams of artists, curators, scientists and PhD research students to investigate scientific concepts through the exploration of creative space. What has been learned from the project, and are any of the benefits transferable to schools without the NESTA investment?

CAPEUK deliberately encouraged the teams to define their own concept of 'creative space'. This could mean:

- Creating a stimulating physical environment
- Creating space for a more experimental exploration of science within a crowded curriculum
- Creating mental space for experimentation

Several teachers entered the project with a preconception that the project was about creating a permanent change to the physical environment of the school, and that the NESTA project would fund this. They wanted to convert an old-fashioned science laboratory into a more stimulating learning environment, or to create an interactive science play area within a primary school. In the event, whilst some of the projects did create stimulating temporary physical environments, they became much more experimental in terms of curriculum delivery.

Notes & Remarks

Notes & Remarks

The challenge for schools - especially for secondary teachers of science - was to enter into a process of experimental collaboration with no known outcome. After eighteen months of experimentation and exploration, the project has raised many questions about the teaching of science:

- **Can the current system provide the time to support genuine experimentation?**
- **How can we ensure a continuity of positive scientific experience between Key Stages 2 and 3?**
- **Is it possible for schools to draw on external expertise as a matter of course, rather than as an exceptional experiment?**
- **Can creative science teaching flourish without a whole-school commitment to creativity?**

CAPEUK brought all the teams together regularly to reflect on project progress, and to enable each team to share their experiences and gain confidence from each other. However, not all the Creative Space teams were successful, and some failed to get off the ground. CAPEUK had problems recruiting sufficient creative practitioners with appropriate skills and experience to work in such a long-term collaborative project. Most creative practitioners who work in schools are more familiar with delivering a short-term workshop than a long-term collaborative programme, so this experience was just as challenging for them as it was for the teachers. In some instances, the personalities of the team members just did not gel, or external factors prevented the school from engaging in the project over a long period. But these negative experiences only served to highlight the positive aspects of those collaborations that were highly successful.

In successful schools it was notable that:

- Sustained partnership between creative practitioners, teachers, and pupils had led to each trusting the judgment of others.
- The senior management team supported the project, facilitating flexible timetabling and encouraging teachers to innovate and take risks - indeed, in one case reassuring the teacher that it was OK if the project failed.
- All partners were open to experiment and to taking risks, with teachers willing to relinquish control of the classroom on occasion.

The project aimed to achieve enhanced commitment to science by the pupils involved in the experiment. A wealth of research material resulted, mainly in the form of testimonies gathered by the researcher from Sheffield Hallam University from pupils,

teachers, creative practitioners and research scientists, and it has generated two publications: a research report, and a toolkit for practitioners.[7]

It is evident from the research that youngsters' attitudes were positive towards the Creative Space experiences, and for a large number they proved motivational, engaging and inspirational. The permanency of these attitudes is difficult to measure without longitudinal tracking, but there is a legitimate argument that increasing motivation and developing better attitudes to science is likely to improve attainment in the longer term.

Although it was not a research objective to measure cognitive gains in understanding from the project interventions, some teachers did indicate that pupils demonstrated unexpected improvement in science attainment, showed a more thorough understanding of science concepts, and had more confidence in science learning. Whilst this cannot be proven from the research, it is encouraging, and is certainly worthy of note and further focused work.

The project has undoubtedly provided insights into the range of methodologies that can potentially enhance and improve engagement and creativity in science learning.

Modelling, analogy, dialogue and demonstration were valued as methods through which the creative processes of discovery, improvisation, hypothesising, predicting, testing, evaluating, experimenting and questioning could be encouraged. Are there lessons from the Creative Space model that can be replicated elsewhere?

It is clear that the Creative Space model cannot be rolled out nationally without significant investment, and that is unrealistic. Anyway, there simply would not be enough PhD science students or creative practitioners to sustain it. Furthermore, many science teachers already have the necessary skills and enthusiasm to teach more creatively without the assistance of creative practitioners. What they need is time and space in the curriculum to implement more creative teaching strategies, and for these to be recognised in the assessment process. QCA's consultation on the future design of the science curriculum suggests: 'There is considerable evidence that inspired teachers inspire learners. Teachers need to maintain their own enthusiasm for the subject by continuing to be learners. **By emphasising imagination and creativity teachers can communicate their enthusiasm for the subject and show learners what it means to learn like a scientist.'**[8]

Notes & Remarks

[7] Sheila MacGregor, Creative Space: collaborative approaches to science learning in schools, CAPEUK, 2005;
Lynne Bianchi, Creative Space: the research report, CAPEUK and Sheffield Hallam University, 2005.

[8] QCA, A Curriculum for the Future: subjects consider the future, 2005.

Notes & Remarks

There are significant lessons to be learned from the Creative Space evaluation, and there are opportunities to disseminate the results alongside other projects with similar aims.

Is now the time to learn collaboratively from all the experiments by CAPEUK, NESTA, Creative Partnerships and others, and to develop a national programme which develops new models of teaching and assessing creatively in science, and encourage schools to experiment with new partnerships in the science lab?

The time seems absolutely right because:

- The recent review and changes to the KS4 science programme of study from September 2006 present a unique opportunity for change.
- QCA is encouraging debate about the future of the curriculum, emphasising the importance of moving science away from a knowledge-based culture, learning from other subjects and emphasising imagination and creativity.
- Ofsted is increasingly listening to pupils' views, and taking note of pupils' enjoyment.
- With workforce remodelling, schools are increasingly used to having a whole range of professionals operating in the classroom.
- With increasingly flexible budgets many schools can afford to pay to develop a long-term relationship with a creative practitioner without additional support.[9]
- There is a pressing need to recruit and retain science teachers, which could be stimulated by encouraging more innovative practice.
- The Training and Development Agency for Schools has recently confirmed its commitment to the training and development of all teachers, whilst the introduction of a national network of Science Learning Centres has provided improved access to CPD in science.

Such a wholesale change would not be without some significant challenges. How can we persuade 'successful' science departments of the value of integrating more creative approaches into their established practice? Doesn't the CAPEUK model require some radical changes to the timetable, such as collapsing of lessons? How can we appeal to school leaders to encourage teachers to take greater risks in their teaching practice, to introduce timetabling changes, and help them include a variety of evidence in their self-evaluation?

[9] Creative practitioners typically cost a similar sum to supply teachers.

How do we encourage science teachers to become more experimental and especially to relinquish the often obsessive need to control classroom outcomes? How do we persuade examining bodies to give credit to more creative approaches to science learning? Where a need for support from creative practitioners is recognised, how will schools identify effective people to work with their science teachers? Are there enough good creative practitioners out there to facilitate a nationwide experiment? What about those schools which have less flexibility in their budgets?

None of these problems are insurmountable, and certainly should not prevent a significant nationwide research project to stimulate more creative teaching of science. The planned changes to the curriculum are a welcome step forward, but alone they may not change student attitudes to science and engineering. There has been an abundance of interventionist experiments in science departments within schools all over the country which have had a positive impact on student attitudes to learning science.

The time is now right to learn collectively from good practice, and to mainstream a nationwide research project. In the interests of ensuring that the UK remains a major player in the fields of science and engineering in the future, can we afford not to adopt a more innovative approach?

Notes & Remarks

Notes & Remarks

Resources & Ideas

Find out more about the Creative Space programme - a two year research programme working in Leeds and Manchester schools. The programme was supported by NESTA and also drew on previous projects supported by the Granada Foundation.

A journal article
Primary science review journal
November December 2005
Article by Dr Lynne Bianchi
Available from www.ase.org.uk

A handbook for teachers creative practitioners and others working in the field of science learning
Creative Space - collaborative approaches to science learning in schools
Published by CAPEUK (now known as IVE) – November 2005 Available from www.weareive.org
This contains a comprehensive list of resources and organisations which support innovation in science learning in schools

The full research report
Creative Space - the research report
Dr Lynne Bianchi Sheffield
Available from www.weareive.org

Other recent publications supporting creativity and science
Real Science
A report which draws on all of the science learning work with children and young people
Available from www.nesta.org.uk

I wonder ...
A creative science springboard
Available from www.creative–partnerships.com

Acknowledgements

With thanks to: Dr Lynne Bianchi, Pat Cochrane, Patrick Dower, Andy Hind, Julie Jordan and Sheila McGregor for their ideas, encouragement and feedback that have helped shape this paper.

Thanks to Bill Harrison Emeritus Professor of Science Education, Sheffield Hallam University whose enthusiasm, support and encouragement made the Creative Space project possible.

Thanks too to all the students, teachers and creative practitioners involved in the CAPRUK Creative Space project for their inspiration, and to NESTA for enabling it to happen.

About IVE (formerly CAPEUK)

IVE is a social enterprise that is working to ensure a more creative future for businesses, teachers, children and young people.

We were established in 1997 as CAPEUK and have been at the cutting edge of creative learning policy and practice for more than 20 years.

Further Reading

IVEUK Creativity Matters include:

- Creativity Matters **01 Creativity**
- Creativity Matters **02 Social Inclusion**
- Creativity Matters **03 Science**

To access these documents as PDF files go to: **www.weareive.org**

This booklet has been supported by funding from:

ARTS COUNCIL

innovation

department for education and skills

ISBN 0-9549324-7-1
2006

nesta creative investor

CREATIVE INNOVATIVE SUPPORTIVE

Exploring creativity for teaching and learning
Working in Research Training and Consultancy

31 The Calls
Leeds
LS26 0QZ

Tel 0113 322 3050
Email hello@weareive.org
www.weareive.org