

As part of the UK Government's drive to unlock creative talent, £135 million has been allocated to enable young people to get five hours of culture a week. Included in the funding is the *Find Your Talent* scheme, which gives young people in England the chance to experience high-quality arts and culture. The initiative will be accompanied by an expanded *Creative Partnerships* scheme, which allows children and young people in schools to work with creative professionals such as artists, writers and actors.

This initiative also endorses the trend towards cross-curricular teaching. The recently revised primary frameworks for numeracy and literacy, acknowledge that *'Making links between curriculum subjects and areas of learning deepens children's understanding by providing opportunities to reinforce and enhance learning.'*

Hence, this issue of *Primary Science* sets out to support these current trends, as we feel that they help to bring down subject barriers and the constraints that these divisions can put on teaching and learning. The real world is not neatly divided into separate subjects, especially in the minds of children; human achievements (scientific, technological and artistic) often defy such conventions, clearly visible in such examples as buildings, machines, furniture, the media, clothing and many other fields.

The traditional academic split between the 'arts' and the 'sciences' is a good illustration of this compartmentalised take on life. The idea that people who work within the 'arts' (those sensitive, fiery, colourful creatures) think, feel and behave in a completely different way to scientists (the clever, disciplined, nerdy types) continues to permeate societal, parental and educational views and values. There is a continuing perception that the sciences are of higher intellectual value; if you are 'brainy' then you are wasted in the arts. At key educational junctures, your decisions about what subjects to pursue are often constrained by these views, as choices are whittled down to an either/or path. How often are these cultural stereotypes reinforced in how we see others ('*you should know – you're the science geek!*'), in the books and recreational activities we choose to engage with ('*it's too arty for me*') and in the everyday interactions that we have with the children that we work with ('*I can't draw/sing/do maths*')?

In our view, children naturally seek explanations of the world around them and they are often attracted to phenomena by aesthetic experiences leading to a sense of wonder, often referred to as the 'wow!' factor. They notice trends and patterns that often lead to the creation of personal explanations fuelled and influenced by their imagination. They may then need or want to share their explanations of the phenomena, and explore their ideas further. And it is this process, of exploring and communicating about the phenomena that excite them, that both science and the arts have in common. People, including children, almost unconsciously use both artistic and scientific ways to communicate their observations and understanding about things that excite or puzzle them. In Einstein's words:

*The most beautiful thing we can experience is the mysterious. It is the source of all true art and all science. [Those] to whom this emotion is a stranger, who can no longer pause to wonder and stand rapt in awe, [are] as good as dead: [their] eyes are closed.*

Some of the most ground-breaking, inspirational work that we continue to celebrate comes from artists and scientists who dared to fuse the two together. The artist



Helen Storey explored her sister's scientific research into embryology: her exhibition, *The Primitive Streak*, showcases her creations of high spec fashions based on the first few hours of a baby being created. Leonardo da Vinci is famous for the *Mona Lisa* and also for the advances he made in anatomy, civil engineering and optics. He conceptualised the helicopter and found a way to concentrate solar energy. Monet didn't mix his own paints; he relied on premixed paints and synthetic colours invented by French chemists. Blue colours had previously been very expensive as they were made from lapis lazuli, a semi-precious stone; Monet could not have afforded it. So those wonderful water lilies are all

thanks to the chemists. Arthur C. Clarke was a great bridge between science and arts. In the *Space Odyssey* series, he anticipated ideas and inventions that were ahead of his time, like satellite communications.

In 1632, Galileo presented his controversial arguments for the idea that the Earth revolves around the Sun, through a discussion – a play script in some senses – between two philosophers and a layman. This seminal text, *The Dialogue*, was eventually placed in the *Index of Forbidden Books* until 1835, and led to Galileo's conviction for heresy and eventual life under house arrest. He reminds us that art and science not only require us to explore and experiment creatively and imaginatively; they both also require the sharing and communicating of ideas and impressions of the world. Science needs imagination – try thinking about molecular structures such as the DNA double helix – just as imagination is fundamental to artistic creation. Science is fundamentally as creative as the arts; but the way it is often taught does not take account of this.

The articles in this issue show how breaking down subject boundaries enhances children's understanding by equipping them with a range of perspectives or alternative lenses. They help us to understand the science behind artwork of different kinds: for example, understanding sound helps us to appreciate music, while understanding the properties of materials influences how sculptors work with wood, clay, metal, ice, sand and plastics. Other articles demonstrate that making relevant links between the sciences and arts creates opportunities for creative and innovative teaching: for example, drama and dance are shown to be great ways for younger children to express themselves before they have the language to do so. And several pieces remind us how drawing and painting can enhance children's observation in any discipline. These examples offer kinds of learning that can be personalised to suit the range of needs of children, as well as motivating both the learner and the teacher. We cannot emphasise enough how real engagement in exploring their own interests can become the key factor in children's successful learning, whether it be in science or the arts.

Collectively, therefore, we hope the articles in this issue help teachers to feel less daunted and overwhelmed by including more contexts and teaching approaches amidst all the pressures and constraints that school life demands, and that they serve as a reminder that learning is an outcome of asking real questions about real concerns. It is about helping children to see that 'real' scientific endeavour is not always conventional. Like artists, scientists look at things from different angles; their curiosity is often fired by something interesting in everyday phenomena and they tackle problems with flair and ingenuity. As Einstein also said: *to raise new questions, new possibilities, to regard old problems from a new angle requires creative imagination and marks real advances in science.*