

trend exposes the failure of the many changes to make enough of a difference.

‘Unless we break the cycle of politically motivated, knee-jerk reactions and constant change, we are in danger of never giving reforms the time that they need to bed in and therefore not getting to grips with what works and what doesn’t.

‘To ensure that education reform is driven by the needs of education rather than the sometimes short-term agendas of politicians, there is clearly a need for a fully independent body respon-

sible for curriculum reform in each of the UK nations.’

The report highlights that the new science GCSEs, which were sat by the first major wave of students this year, were introduced before any genuine evaluation of the pilot had been undertaken. Similarly the new science diploma that the government intends to launch in September 2011 is being developed in a timeframe that leaves little time for it to be adequately tested.

Prof. Reiss said: ‘We cannot expect major curriculum initiatives to succeed unless they are

based on the best evidence and properly piloted.’

Prof. Dame Julia Higgins, chairperson of the report’s working group, said: ‘A high-quality education in science and maths is central to sustaining a thriving economy. Unfortunately our report shows that education in the UK is failing to provide the increases in the numbers of school-leavers with the qualifications in these subjects required by industry, business and the research community to assure the UK’s future economic competitiveness.’

CONFERENCE

Edmonton enjoys a physics-show treat



Physics in performance at the Association of American School Teachers Edmonton meeting.

If you played a word-association game with someone and said ‘physics’, what words do you think they would say back to you? Science? Difficult? Einstein?

It would depend on who you asked, but it is highly unlikely that they would say ‘performance’. So it was with some trepidation that Wendy Sadler and Stan Micklavzina embarked on a workshop at the Association

of American Physics Teachers Edmonton meeting, with the aim of encouraging more physicists, lecturers and teachers to embrace a variety of performance techniques to spice up their physics presentations.

Luckily this was not a first foray into the area for either of them, having first met in 2003 at the Physics on Stage 3 event in Noordwijk, the Netherlands.

Sadler and Laura Grant were running a Physics and Performance workshop that incorporated the infamous ‘physics karaoke’ (Grant), as well as a workshop about whether you could communicate physics without words (Sadler). Micklavzina was an enthusiastic contributor and honorary UK Institute of Physics (IOP) delegate, and one of the magic moments of the resulting



(Left) *The glass-of-water demonstration revisited.* (Right) *The world's biggest oscilloscope.*

performance was a new version of 'Here comes the sun' to the words of 'Here comes the sound', on ukulele and wine glass. Micklavzina had already been experimenting with the use of performance in his physics shows in conjunction with theatre and circus performers, but he was keen to do more.

In 2005, Sadler's company, Science Made Simple, put on a new type of physics performance called *Visualise—the Beauty of Science*. Funded by an IOP Einstein Year grant and with additional support from the National Endowment for Science, Technology and the Arts, this was an experiment into whether you could communicate the beauty of science without using any words.

Company members learned very quickly (through various shortcomings) that putting on a professional theatre show is technically difficult and pretty expensive to do well. Although happy with the first incarnation, they knew that the show could become much better with help from experts. With support from the British Council, they were able to develop the concept and, with input from the Royal Welsh

College of Music and Drama, they were ready for a tour of nine countries in southeast Europe and an appearance at the Edinburgh Fringe Festival by 2007.

Input from physical theatre experts and lighting technicians, and the addition of a second character on stage, turned what was a slightly snazzy demonstration show into something much closer to their goal of a slick theatre performance. Sadler and her company were thrilled when the show was a Fringe sell-out and was shortlisted for a Total Theatre award against 400 other productions nominated that year.

Also in 2005, Micklavzina in the US combined efforts with circus performer Rhys Thomas to create a show called *From Newton to Einstein*, in which various styles of juggling and circus balance acts interacted with physics demonstrations to show Newtonian physics, and also to model modern physics principles such as special relativity and the photoelectric effect.

With these experiences in mind, Micklavzina and Sadler wanted to run a workshop to share best practice and get others thinking creatively about new

approaches to physics communication. They had both found that using performance resulted in a finished result that has a much wider appeal than the standard lecture-demonstration. They were also both frustrated with seeing the same things over and over, rather than any attempt being made to find new ways to present them.

Life became more exciting when they learned, just before their arrival in Edmonton, that, rather than contributing 10 minutes of material from the workshop for the big conference, they were now responsible for producing the whole 45 minutes, and that the show was going to be opened up to a public audience as well. The workshop then became less about reflecting and coaching, and more focused on how a show could be put together with the group of people who had signed up for the workshop—a real active learning process.

Sadler said: 'We had about 12 people and just seven hours of rehearsal time. I felt like I was in a particularly difficult episode of *Challenge Anneka*.'

Luckily the workshop was full of fantastically creative physicists,



(Left) *The whirlling tube.* (Right) *A spark[li]ng fairy story.*

including demonstration experts from all around the US, Per Olaf Zetterberg from Sweden, and the team from The Physics Factory, an outreach group from Tucson, Arizona, that travels in an old bus that runs on cooking oil, laden with amazing physics demonstrations. For this event The Physics Factory had driven from Tucson to Canada, doing various science-club events along the way.

After a basic discussion of various performance types, and with some development and rehearsal time, the end result was that some groups performed without words, some used storytelling as the performance tool, others used dance and finally we had a reprieve of the ukulele classic 'Here comes the sound'. With two collaborative performance pieces by Micklavzina and Sadler, the show was set. After two days of frantic snatches of rehearsal, music and image sourcing, and a very hasty dress rehearsal so that the theatre technicians had a vague plan of when to switch the lights on and off, they nervously approached curtain up.

The quality and variety of the performances were brilliant and the audience went wild. Highlights

included the Sadler-produced introduction slides and looking at how waves from a whirly tube lead to standing waves on a large Lycra rope. That was followed by musical straws serenading the centre of a balance 'snake' (originally created by Ben Craven); an ingenious physics fairy-tale to frame an amazing demonstration by Martin Simon from University of California, Los Angeles, where a human heartbeat can be seen using a mirror on a roller, a loud challenge by the crew from Sweden, and a heavy gas boat float by Roger Moore (not quite 007) from the University of Alberta. The show finale was set to Queen's 'Under pressure' and involved a choreographed pressure-demos dance developed by Micklavzina at the University of Oregon, which included chairs being picked up and held by air pressure, and culminated with the big bang of an oil drum implosion.

Sadler said: 'Many delegates came up to us over the next 24 hours to say that the show had been a breath of fresh air from the usual demo show style, and that they intended to take some inspiration from it back to their organizations. It would be great

to run a similar workshop in the UK and, in retrospect, having a public performance at the end actually forced us to come up with some tangible results that might not have happened without that added pressure.'

The power that performance has to bring physics demonstrations to life was clear in the faces of the audience, but Sadler and Micklavzina think that this is the way to engage those who would not normally come to a more traditional science show. Sadler concluded: 'Theatre touches emotions, and unless we can get people to emotionally connect with the beauty and wonder of physics, we may be only preaching to the already converted.'

So next time someone says the word 'physics' to you (or at least 'physics show'), think 'performance'.

You can see a film of the show at <http://uoregon.edu/~physdemo/edmontonshow>.

Wendy Sadler, *Science Made Simple*

Stan Micklavzina, *University of Oregon*

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