

BAD SCIENCE?

Vanessa Kind is determined to improve how chemistry is currently taught in many secondary schools – and she wants you to be part of the process...



I decided a few months ago to start piano lessons after a gap of over thirty years. Spurred on by my son, one Saturday morning, feeling rather nervous and intimidated, I reported to his music teacher's house, sat at the keyboard of Barry's imposing grand piano, and started to play. I was a learner once again. After a few weeks, I began to gain confidence, and realised this was not at least due to Barry having a number of qualities that make a really good teacher. First, he starts from my starting point, however slight this may seem. He makes me feel unashamed of small achievements. Even a few bars played at a fraction of the correct speed gives him enough to help me make a start on a piece. Secondly, he is unfailingly patient. I make mistakes and mostly don't get things right first time. Pieces we work on often sound, he says, "like building sites", as I experiment with fingering and phrasing, learn to emphasise tunes, minimise accompaniment and find complex chords. Thirdly, he is exacting. I know I can't slack. He shows disappointment if I have not worked between lessons. Consequently, I feel I have to practice and turn up having done my homework. Fourthly, Barry's praise is hard-earned. I can't rely on soft encouragement, but must work to get something meaningful. When I finally get praise, I go home full of it, as if I have won a coveted prize. And finally, lessons are interesting. The

time simply vanishes, as I am absorbed in the simple act of making music. With Barry's help I got a merit in my Grade 8 exam in March, feeling a tremendous sense of achievement when the certificate finally arrived.

This experience reminded me of the very special days when, as a chemistry teacher, students came to me waving their A level results slips. The most memorable occurred following my doctorate degree. I carried out a longitudinal study tracking students' understandings of chemistry concepts, investigating how these change during an A level course. I found students start with specific misconceptions, and worked out how to teach effectively to address these. I put my ideas into practice afterwards, taking a job in a sixth form college in Hull. My teaching changed completely. I spent time sorting out students' misconceptions about basic ideas, invented new activities to expose their thinking, and used their ideas as starting points for building understanding. I worked with them to construct their thinking, explaining even the most basic concepts such as 'a chemical reaction produces a new substance', 'mass is always conserved' and 'the bubbles in boiling water contain steam'. I reminded students of these lessons when we met concepts that assumed these were understood, using them as building blocks for more complex ideas. For example, understanding electrolysis



requires good knowledge of ions and ionic bonding. After two years, students took their exams (we're talking mid-1990s, so no modules and resits available then!) Our chemists achieved a 100% pass rate, an amazing result at the time for a college like ours. Chemistry was the only subject to achieve this except for textiles (which had only two students). One of our students won a place to read Natural Sciences at Cambridge, and 75% got grades C or above. My colleague and I boasted about these results for weeks afterwards. The college management was delighted. Nothing I have done professionally since then has matched the satisfaction I felt in knowing that I had contributed to their success.

I would like more chemistry teachers to be able to share this sense of achievement. However, I know that there is a lot of rather dodgy practice out there. For example, I have heard teachers talk about atoms 'holding hands' as they form bonds and 'swapping partners' on reacting. Atoms also have brains, as they 'know' what to do in any situation, and are 'happiest' with eight electrons in their outer shells. A chemical reaction involves 'mixing' chemicals, 'like mixing paint', or 'baking a cake'. Chemistry comprises rote learned ("Don't worry about it, just learn it!") material, or, worse, partial truths that require unpicking later ("covalent bonds are stronger than ionic bonds"). Frankly, chemistry teaching is often poor quality, with students' results to match. To coach successful chemists, this sort of rubbish needs to stop. We need consistently excellent chemistry teachers. Given that around 55% of incoming science teachers have biology backgrounds, support to teach chemistry well is needed. I want to help develop excellent chemistry teachers by rooting out activities that motivate, develop, and inform students' understandings of chemistry concepts, eliminate misconceptions, driving them to achieve well in examinations and be enthused about the subject.

To do this, the Royal Society of Chemistry's Chemical Education Research Group is undertaking a project designed to help inspire the next generation of chemistry teachers, as well as those needing new ideas. The project is called Describing Practice in Chemistry Teaching, or DePiCT. We want to collate and analyse how chemistry is taught. If you have a good idea that you know is effective for teaching a chemical concept, such as using a model, an experiment, illustration, analogy, or activity that you would like to pass on to others, please let me know (see below).



ABOUT THE AUTHOR

VANESSA KIND IS CURRENTLY DIRECTOR, SCIENCE LEARNING CENTRE NORTH EAST, AND READER IN EDUCATION, DURHAM UNIVERSITY SCHOOL OF EDUCATION. VANESSA TRAINED AS A CHEMISTRY TEACHER IN LONDON WHERE SHE TAUGHT IN VARIOUS SCHOOLS PRIOR TO UNDERTAKING A DOCTORATE DEGREE AT YORK, WORKING ON MISCONCEPTIONS IN CHEMISTRY. THIS LED TO WORKING IN TEACHER EDUCATION AT THE INSTITUTE OF EDUCATION AND DURHAM UNIVERSITY. VANESSA'S CURRENT RESEARCH INTERESTS ARE IN PEDAGOGICAL CONTENT KNOWLEDGE, AND HOW THIS DEVELOPS.

DePiCT will build an authoritative compendium of effective strategies and make these available to others. We want activities that motivate, develop, and inform students' understandings of chemistry concepts, and eliminate misconceptions, driving them to achieve well in examinations and be enthused about the subject. We hope DePiCT will result in a high quality guide to chemistry teaching, as it is really done, in a variety of settings, by really effective chemistry teachers.

In proposing DePiCT, in my heart, I want other chemistry teachers to experience the same sense of success I had from working with my students in Hull. There are excellent teachers around who achieve great results year in, year out, but plenty who don't. The knock-on effect is mediocrity, frustration, despair and students' talents wasted. My recent experience as a piano student has reminded me of the fantastic feeling of achieving something meaningful with the support of a great teacher. DePiCT aims to capture the best, make it available and inspire the next generation of chemistry teachers – and their students.

If you know a teacher, or are a teacher, don't be modest. There are plenty of colleagues and students who will benefit from your expertise. Please contribute to DePiCT. Start by sending me an email (Vanessa.kind@durham.ac.uk) and I will be pleased to get back to you with a proforma to complete. Let's raise our game, and help create the best chemistry teachers and students we can.

