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Michael Seery's Homepage

What's wrong with Leaving Cert chemistry?

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A nasty physicist once remarked that all of chemistry can be summarised as acids reacting with bases. I laughed it off at the time, but that casual remark made me think long and hard about my subject. Could it be that chemistry could be reduced to this? Could all of those reactions be distilled down to a simple subset of the larger branch of physics, the subject which truly aims to understand what is going on?

And there are a lot of reactions in chemistry; sub-divided into the various branches of synthetic chemistry – organic chemistry with its myriad of different types of reactions depending on the nature of the molecule, only with carbon in common – and inorganic chemistry, studying the reactions all of the other elements on the periodic table. The categorisation of reactions is in every chemist's DNA. From very early on, we start the index card set, distinguishing between reaction types from the start, and then as time goes on, adding more and more complications and sub-categories into the ever expanding folder of reactions. So when we design syllabi, this is the obvious way to approach it. The trouble is, that it is, to be honest, quite a boring approach. Worse still, most chemists, even the very good ones, might know how the mechanism of a palladium-catalysed carbon-carbon bond coupling works (if that even exists), but probably are not sure of its use, if ever, in The Real World.

The Real World is where most of students sitting the Leaving Cert will end up. There are three types of student studying Leaving Cert chemistry. The first is those with an interest in science, and who see, like in the good old days, that learning about Thompson and Kekule are all part of the bigger picture, and are in it for the long haul – they want to have an index card set. The second group are those who study chemistry for another discipline – they want to study medicine or pharmacy and know having chemistry will give them a head start. These students are highly motivated, but probably don't care if the main text is the Sceptical Chymist; they will learn what is

required. Finally there are those who might try chemistry just as a subject to do, but have no intention, at least at the start of 5th year, of ever pursuing the subject further. An enthusiastic teacher is probably the most likely reason they might change their mind. The Leaving Cert syllabus has the difficult job of addressing these different types of students. Therefore, consultations such as the NCCA's recent round on the revised syllabus, will largely argue about whether students need to know that electrons can live in spheres or dumbell-shaped houses spinning around in different directions and how much historical chemistry is required to give students a sense of how the subject evolved and how we know what we know. An occasional bolt-on topic (forensic science is the current favourite) is used to provide interest in among the variety of acids and orbitals and carbon-carbon bond configurations students will learn about. But instead of worrying about content at the micro-level, I argue that all students completing Leaving Cert chemistry should all know and be informed about chemistry in The Real World. By taking this approach, we address all learners taking the subject by providing them with core ideas about how chemistry happens and is important in every day life. We might even encourage a few new learners too.

When teaching my final year module in photochemistry, I show my students the top ten problems facing the world at the moment: energy, water, food, environment, poverty, terrorism & war, disease, education, democracy and population, and state that the content we are about to cover in the following nine lectures will address at least four of these in detail. (Can you guess which?!) We do some fairly complicated chemistry on the way, but all the time with the context in mind. This is a tiny subsection of chemistry at the highest undergraduate level, but yet has this impact and value. Some of my students have gone on to work in this area when I doubt they would had the course been taught from a traditional approach. It is here that I can face down my physicist and say that while chemical reactions may be acids and bases, selecting and applying them in The Real World is intricate, complicated, and downright messy. This context-based approach I think would suit the Leaving Cert very well; identify several contexts that the course will be delivered through. Instead of learning about atoms and isotopes for the sake of it, teach it for the purpose of understanding it in a context. In this way, when students complete a course, they are much more likely to remember it, and become more informed citizens because of it. Leaving Cert chemistry textbooks and resources should be showcases for the application of the living vibrant every day subject.

The NCCA in their latest suggestion have several "units", one of which is "Scientific Methods". I am already bored. Why teach about "scientific methods" when you can invoke the scientific method through a range of examples and problems and messy real-world examples. The document proposes that learners will, for example, "develop intellectual and critical thinking skills" and "show imagination, intelligence, intuition, *and other talents* through … curiosity… enquiry…" Quite what the other talents are is unclear, but what is clear is that there is no scope for showing imagination or developing critical thinking skills in the current model. "Scientific Methods" is akin to the stupidity of "Professional Skills" modules endemic at third

level – modules about how you would present if you had to and how you would work in teams if you had to. We are moving away from this to embedding these skills into the curriculum. Similarly, bolt on examples such as the forensic science topics don't wash any more. Students see through this. You can't have eight classes on core topics and say in the ninth that "this can be applied as I am now showing." The terrible thing is that it is now so easy to teach through context. There are so many resources available. Schools should not only be doing this but be way ahead of us at this – it's what students are used to from primary school. The other units are boring, dry, featureless and obsessed with content. No change from before. Students, even those with a keen interest, will remember little after the exam. It has no relevance, so why would they? Context is the key!!

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3 THOUGHTS ON "WHAT'S WRONG WITH LEAVING CERT CHEMISTRY?"

mark glynn
on **May 5, 2011 at 7:54 am** said:

I could not agree more. You do not stick a plaster on a rammed that is leaking, patch up jobs never work. Wholesale changes need to be made by people who are not close to retirement! People who know what will spark the interest in students

John Phelan
on **May 10, 2011 at 5:02 pm** said:

@mkseery Hear Hear!

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