

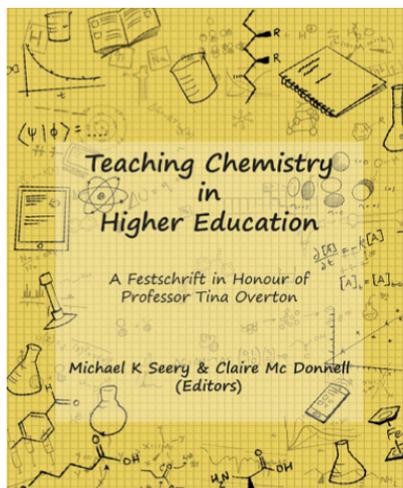
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Michael K Seery and Claire McDonnell (Eds.), *Teaching chemistry in higher education*, Creathach Press, 2019; 452 pp.; ISBN: 978-09-928-2331-3

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The book 'Teaching Chemistry in Higher Education' is a compendium of different chapters authored by respected high education chemistry teachers and chemistry education researchers from the United Kingdom, Ireland, and Australia. In addition, this book is also dedicated to Prof. Tina Overton, one of the most prominent chemistry education researchers. Authors of the chapters came from the aforementioned countries, where Prof. Overton made a significant impact as a high education scholar and researcher, before retiring last year. This book was edited by two distinguish chemistry education researchers, Michael Seery and Claire McDonnell. Seery is a Professor of Chemistry Education and Director of Teaching at the School of Chemistry at the University of Edinburgh. He is also editor-in-chief of one of the most respected international journals in the field of chemical education research, *Chemistry Education Research and Practice*, published by the British Chemical Society, with an impact factor of 2.29 in 2019. Claire McDonnell is an Assistant Head of the School of Chemical and Pharmaceutical Sciences at Technological University Dublin.

The forward to the book, by Professor Overton, illustrates her professional development in the field of chemical education research. Because her research interest in the great portion of her professional career was involved working memory and problem-solving abilities, laboratory teaching and learning, and graduate employability, she gives the readers in this section of the book some theoretical background to these topics (Overton, 2019). Altogether, the book comprises 452 pages.



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In the introduction to the book, the editors attempt to discuss its relevance, not just as a compilation of pseudo-papers but a work that can be useful, inspiring, helpful, and pragmatic. They also elaborate how the authors of the specific chapters were selected and that an essential aspect of the book is to show to the readers 'their knowledge on a particulate aspect of their own innovative work in the teaching of chemistry' (Seery & McDonnell, 2019).

Each of the 29 main chapters begins with the aim of the chapter and with the 'Influence of Professor Tina Overton' on the author(s) or content of the chapter. The main body of each chapter comprises some theoretical introductions of relevant literature and theory for the reader to understand its framework. In continuation, some results are presented, illustrating author(s) work in the context of teaching different chemistry courses in higher education implementing specific teaching and learning strategies. Toward the end of each chapter, there is a section about implications and adaptability; however, the author(s) of each chapter also attempted to suggest some guidelines for readers from different contexts to use the described teaching and learning approaches in their lecture rooms or laboratories. Some chapters are supplemented with further reading materials on the book's website ([overtontestschrift.wordpress.com](http://overtontestschrift.wordpress.com)). The unique structure of each chapter indicates that this book is not just a collection of different teaching and learning approaches that individuals use in their professions; rather, it offers a great source of opportunities to upgrade and modernise the tertiary chemistry education globally.

Reading the book, one can get an impression that the chapters can be categorised into six groups, although the editors did not make this assumption, and they probably had their reasons, but putting the chapters into specific groups would probably help some readers find the relevant information more easily. However, this review tries, more or less, to do so, so perhaps this can contribute to the higher clarity of the book for potential readers.

One group of chapters comprising Kristy Turners' chapter entitled '**A framework to evaluate the transition to undergraduate studies in chemistry**', David Reads' et al. entitled '**Nurturing reflection in science foundation year undergraduate students**', and Suzanne Fergus' chapter entitled '**Using PeerWise to support the transition to higher education**', deals with the transition from secondary to tertiary education. This aspect is quite important, because while it is often taken for granted, it can be quite traumatic in some cases, leading to students failing the first semester or even the first year of their university education.

The second group of chapters discusses the organisation of the teaching of chemistry at the university level. The first chapter, by Aishling Flaherty *et al.*

entitled **‘Working with chemistry graduate teaching assistants to enhance how they teach in the chemistry laboratory’**, and the second one, by Christopher Randles entitled **‘Developing reflective practice with graduate teaching assistants’**, deal with the importance of good graduate teaching assistants’ education in pedagogy, so that they can apply laboratory work adequately. These aspects are not uniform, because in Eastern European countries, for instance, graduate students are not usually employed at the university to offer laboratory courses. These courses are taught by teaching assistants that may have already finished their doctoral degrees and remain employed at the university, offering laboratory courses as long as they want. For that reason, teaching assistants are well qualified to do their work, and the constant education of new ones is not necessary. In contrast, the PhD programmes in other countries are different, and students are tightly engaged in undergraduate programmes.

The third group of chapters can be identified as the richest in content and deals with different teaching approaches that can be applied at the university chemistry education. All authors have significant in teaching courses at the university, so their contributions are most valuable. The chapter by Dylan Williams entitled **‘Context- and problem-based learning in chemistry in higher education’**, and Christine O’Connor’s **‘Approaches to context-based learning in higher education chemistry’** attempt to emphasise the importance of context-based teaching and learning, the relevance of which is also indicated for university chemistry education not only at the primary and secondary levels, where the significance of making chemistry relevant for students is so essential. Peer instruction can be an interesting activity in chemistry lectures or lab work. Simon Lancaster *et al.* in their chapter entitled **‘Peer instruction as a flexible, scalable, active learning approach in higher education’** and Gita Sedghi in her chapter entitled **‘A sustainable peer assisted learning model for chemistry undergraduates’** discuss the relevance of students’ teaching their peers specific content that they find difficult and hard to understand. For that reason, active learning approaches are one of the most important innovations that every university teacher should consider and apply in their lecture rooms or laboratories.

Two chapters deal with the importance of using numbers in chemistry. This means that learning chemical calculations is an important aspect for prospective chemists. Some students have difficulties in applying mathematics to chemistry and, for that reason, Nimesh Mistry’s chapter entitled **‘Diagnosing and addressing the issues faced when students learn stereochemistry’**, Dudley Shallcross’s chapter entitled **‘A pre-arrival summer school to solve the maths problem in chemistry’**, and Daniel Southam’s and Brenda Rohl’s chapter with

the title '**Computational thinking in the chemical sciences curriculum**' can be beneficial for all university chemistry educators. However, students being able to present their work is an essential aspect of someone's learning. For that matter, Katherine Haxton describes innovative approaches to effective students' presentations in the chapter entitled '**Undergraduate screencast presentations with self-, peer-, and tutor-assessment**'.

Another strong field in chemical education at all levels of education is laboratory work, applying inquiry strategies and implement research activities. In light of this, at least eleven chapters of this book deal with different aspects of lab, inquiry, or research activities in chemistry teaching and learning. Pre-lab activities are an important part of tertiary chemical education, and they are described in Dino Spagnoli's et al. chapter with a title '**Designing online pre-laboratory activities for chemistry undergraduate laboratories**'. For pre-lab activities, technology can be used, but different ways of technological solutions should be implemented in chemical education. Barry Ryan's chapter entitled '**Integration of technology in the chemistry classroom and laboratory**' gives some suggestions on how to do this effectively. In contrast, some basic laboratory skills are also important, students have to develop them, and Michael Seery's et al. chapter entitled '**Teaching and assessing technical competency in the chemistry laboratory**' discusses this topic, while Angela Ziebell's et al. chapter with a title '**Overturning a laboratory course to develop 21st century skills**' goes even further.

Four chapters deal with **inquiry-based learning activities in chemistry education** at the university level. These chapters are Jane Essex's '**Implementing inquiry-based learning activities in chemistry education**', Patrick Thomson's et al. '**Introducing elements of inquiry in to undergraduate chemistry laboratories**', Jennifer Burnham's '**Developing student expertise in scientific inquiry**' and Natalie Rowley's '**Developing inquiring minds through learning chemistry**'. However, students have to learn how to lead research groups because they could find themselves in situations after graduation in which these competences would be requested, so Jenny Slaughter's and Lynne Bianchi's chapter entitled '**Student-led research groups for supporting education research projects**' would be a valuable resource.

In the end, reporting of your finding in lab work is also important so Natalie Capel's et al. chapter '**Developing scientific reporting skills of early undergraduate chemistry students**' could give the reader some useful insights. Because internationalisation is an important aspect of tertiary education, providing effective chemistry courses for international students should be an asset, so Julie Hyde discuss this important issue in her chapter entitled '**Design of a**

### **three year laboratory programme for international delivery’.**

Because Professor Overton’s work extensively dealt with problem-solving, some chapters about this topic are also presented, such as Elizabeth Yuriev et al. with the chapter ‘**Developing problem-solving skills in physical chemistry**’ and Gwendolyn Lawrie et al. ‘**Collaborative, scenario-based, open-ended, problem-solving tasks in chemistry**’.

Employability competences for chemistry students become important after they graduate and start applying for a suitable job. For that reason, employability skills ought to be developed during students’ tertiary education. The chapters ‘**Student-led interviews to develop employability skills**’ by James Gaynor, ‘**Implementing community engaged learning with chemistry undergraduates**’, by Claire Mc Donnell and Vanessa Murphy and ‘**Developing business and employability skills for undergraduate chemists**’ by Christopher Pask and Samantha Pugh illustrate this important issue.

It can be concluded that this book is not just a tribute to Professor Overton, but also a great practical guide for all involved in tertiary chemistry education; it also gives some insights into tertiary chemistry education research.

In the end, I would recommend this book to young and not-so-young university teachers to learn how to teach chemistry effectively at the tertiary level, especially because they usually do not have pedagogical education and act on intuition and past experiences during their tertiary education, adapting (more and less successfully) strategies from professors that they find effective. It is also necessary to emphasise that this book can be a valuable source of information to lower and upper secondary school chemistry teachers, although the examples are from higher education, and they usually were part of some sort of pedagogical education in their pre- and in-service teacher education programmes.

## **References**

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