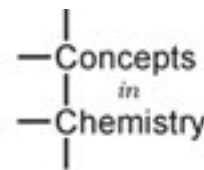


# Re-Inventing our Concept of First-Year Chemistry



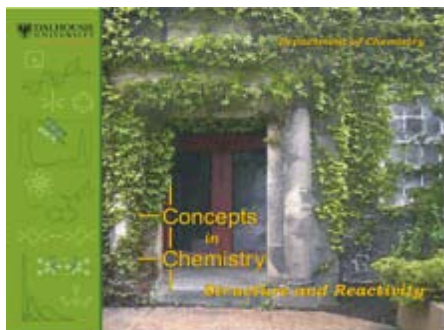
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In considering how to bring “Inspiring Minds” alive for our first year students—arguably the most important students we teach—the Department of Chemistry decided to undertake a complete revitalization of its first year program. Key elements of the new program included the creation of new textbooks and online learning resources, redesigned lectures that focus on active student participation, and enhanced opportunities for out-of-class interactions with faculty members, teaching assistants, and other students.

Preparation for the launch of the new program in the 2006-2007 academic year was achieved through the extensive collaborative efforts of the faculty and staff of the Department of Chemistry. What follows briefly describes the nature and result of these efforts: the new first year program, “Concepts in Chemistry.”



*Concepts in Chemistry: Structure and Reactivity* (fall semester textbook)

## Textbooks

Traditional first year chemistry textbooks are massive books that incorporate many pedagogical tools to promote student success. Typically, however, less than half of the content is covered in a first year course, and the textbook and accompanying resources are underutilized by students because the books are too heavy to carry around and too detailed to effectively support the learning of first year students.

In the early stages of program redesign, the Department reviewed existing textbook resources and concluded that if we wanted a truly effective textbook for our first year students, we would have to write it ourselves. And so we did.



*Concepts in Chemistry: Energy and Equilibrium* (winter semester textbook)

*Concepts in Chemistry: Structure and Reactivity* (used in the fall semester) and *Concepts in Chemistry: Energy and Equilibrium* (used in the winter semester) were written by 22 faculty members, all of whom generously transferred copyright ownership to Dalhousie University. The books are specifically designed to be concise, focused, relevant, and engaging. Students are relieved to find that the *Concepts in Chemistry* books, unlike most first year textbooks, contain no superfluous information; only the content covered in the course is included.

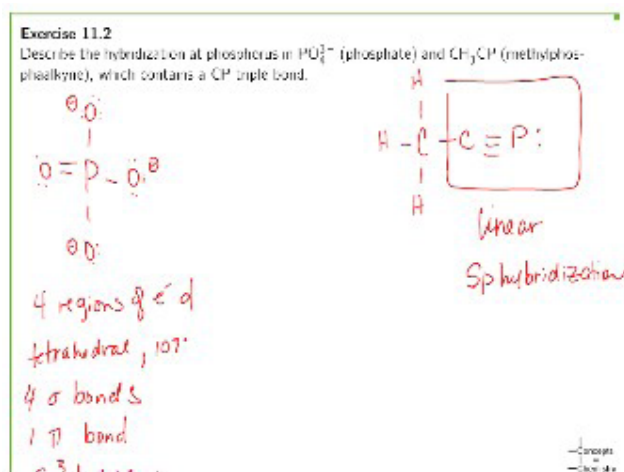
The format of the books is designed to be accessible and to promote active learning: the pages are typeset in landscape format with a third of each page reserved for students’ notes, the book is spiral bound for ease of use, and it is light-weight, which means student can—and do—bring it to each class. As an added benefit, the two books are less expensive than the previously-used textbook.

The design of the books are organized to promote integration into other

aspects of the course. Each of the *Concepts in Chemistry* textbooks is divided into sections of about 10-pages and the contents of each section correspond to topics covered in, on average, two one-hour lectures. Prior to each lecture, students are assigned a “bite-sized” reading from the textbook. They can also review the solved examples and attempt the exercises before class. During the class, the lecturers base the lesson on the textbook and students follow along using the figures, tables, and exercises, while writing annotations and notes directly in the book.

## Lectures

During the inaugural year, lectures were presented in one-hour time slots on Mondays, Wednesdays, and Fridays to over 1000 students in eight sections with a maximum of 160 students per section. This ensured maximum efficiency while maintaining relatively small class sizes.



Sample slide from a first year chemistry lecture

All lectures take place in classrooms in the Chemistry Building—a deliberate part of the design of the program. First, the Chemistry Building provides faculty with the facilities to effectively deliver lectures and engage students. These

facilities include the proper safety equipment for live demonstrations and a large-scale periodic table—an essential reference during each class. Second, as the students wait for class or go from lecture to lab to tutorial, they read the displays throughout the building and they see their teaching assistants and professors doing chemistry in the research labs and talking chemistry in the hallways. This gives them a secondary association with chemistry that they would not experience in another location.

All lectures are taught using a tablet PC that allows the large-screen projection of a real-time image of handwritten material. It is the modern equivalent of a blackboard with the advantage that it is multi-coloured and that images (e.g. figures from the textbook) can be projected and annotated, as the professor or students speak. The students like this method of presentation in which the lecturer actively demonstrates the process of solving a problem or drawing a molecular structure instead of simply presenting a series of slides loaded with text or images. Because the lecturer actually works through these tasks in the students' presence, the pace moves at a comfortable rate for them, creating the circumstances for more effective learning to occur.



Prof. Norm Schepp in The Concept Room

### *The Concept Room*

To increase the potential for faculty-student interaction, we created a “drop-in” centre near the first year chemistry laboratories and the Chemistry Resource

Centre. Known as “The Concept Room,” this area creates a space where, for two hours a day, professors work with groups of first-year students, effectively replacing tutorials and office hours. This face-to-face interaction is supplemented by an online discussion board that allows faculty to correspond with students and to answer their questions.

### *Online Resources*

Students have 24/7 access to online resources through the class BLS (Blackboard Learning Systems) website. Department-designed online assignments provide opportunities both for students to practice and for faculty to assess students' performance. Every semester, for each of ten assignments, students can make 4 attempts over the course of one week, taking up to three hours for each attempt. Almost without exception, students use several attempts as practice before they finally submit one for the required grade.

Online vignettes are short, real-time audio and video clips generated using the tablet PC. The approximately 160 vignettes record professors or an advanced graduate student working through the methodology for solving a variety of problems. These examples provide “just in time” learning resources for students working on assignments or studying for tests and exams.

### *Conclusion*

We are pleased with the results achieved in the inaugural year of the Concepts in Chemistry program. As expected, students made extensive use of the textbooks, completing reading assignments, bringing the books to class, making notes, highlighting important

points, even collectively turning pages as the lecture progressed. Attendance at the Concept Room sessions was optional but this was nonetheless very popular—with standing room only at times. Student response to the online resources was mixed. Some students complained that the online assignments were too time-consuming, taking away

from study time; we continued to emphasize their importance in the learning process and to reassure students that doing the assignments was studying. As for the Vignettes, one student's comment says it all: “Vignettes were very helpful. It was very easy to miss parts of the explanation of problems in class, these gave you a chance to pause, take it all in, and copy it down on your own schedule! Not so rushed. Very useable! A Big Help!”

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— Student Comment

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Overall, students were very positive about the program and complimentary of the obvious interest and effort invested by faculty. Many students provided us with thoughtful and constructive feedback on their experiences and observations—feedback that we are using in editing the textbook and in reviewing other aspects of the program.

While the primary goal of the Concepts in Chemistry program is the improvement of the student experience in first year chemistry, we are also optimistic that this will result in increased student enrolment in the first year as word spreads about the quality of the program and in subsequent years as we are successful in attracting more students to continue their studies in chemistry.

### *Acknowledgements*

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