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CONTRIBUTED ARTICLE:

Author Biography

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Dietmar Kennepohl is Professor of Chemistry at Athabasca University and Chair of the Chemical Institute of Chemistry. He holds university, national, and international teaching awards and is a Society for Teaching and Learning in Higher Education 3M National Teaching Fellow. He is a well-published and sought-after presenter on topics including learning design, learning outcomes, assessment, PLAR, transfer credit, distance and online education, and emerging educational technologies. His research in chemistry education concentrates on the use of online course access including innovative distance delivery methods for undergraduate laboratory work.

Not the Same and Yet the Same[1]

In October 2024, I attended the Canadian Society of Chemical Engineering conference in Toronto and participated in a workshop on chemical engineering education. As a chemist, I was fascinated by the distinct approaches to curriculum design and the disciplinary ethos of chemical engineering, particularly its emphasis on the rigorous professional nature of the field. Every discipline—and even sub-discipline—has its own epistemology, language, culture, and methods. Students are not just acquiring knowledge; they are engaging in an apprenticeship within a unique community of practice. However, for a discipline closely related to chemistry, I was surprised by how many differences I encountered.

Still, I also found significant common ground from an educational perspective. Both chemistry and chemical engineering programs rely heavily on **practical components**, such as laboratory work and design projects. These activities are central to the curriculum but come with high costs—both in time and resources. Another shared challenge is implementing discovery-, problem-, or inquiry-based practical work on a large scale. Often, programs default to more expository, demonstration-based methods simply because they are simply more manageable.

A more serious, underlying concern in both fields is what I would call the "**tyranny of content**." Many science and engineering courses are overloaded with information, choices, activities, and assessments, which can overwhelm students and impair learning (Impelluso, 2009; Sweller, Ayres, & Kalyuga, 2011). It is easier to add content to a course or program than to streamline it. Chemical engineering programs, in particular, tend to also require more courses within the undergraduate degree, adding to the cognitive load.

While content volume presents one challenge, the sequence in which learners encounter concepts is equally critical—poor sequencing can hinder understanding (Smith, Mulhall, Gunstone, & Hart, 2015). There is a long-standing tradition in science education of **scaffolding and building foundational skills** before introducing more complex or engaging content. Yet, this approach often delays access to the truly interesting aspects of the discipline. Sheila Tobias once captured this tension beautifully: "The teaching of math and science suffers from being all scales and not enough music" (1990, p. 42).

One of the highlights of the workshop was the participation of chemical engineering students. During smaller breakout discussions, we had the opportunity to hear their perspectives firsthand. Unsurprisingly, the students confirmed many of the challenges we had identified as educators. They described their programs as a grueling four-year sprint that demanded tremendous personal commitment. When asked what they enjoyed most, the students unanimously pointed to their project work—especially those connected to real-world industry problems. Their passion was palpable as they discussed these experiences. For them, *this* was the music of their educational journey.

As the discussion evolved, one student made an insightful observation. He noted that aside from a few project-based courses, most of the program followed the same formula: midterms, finals, and assignments, all primarily **driven by grades rather than learning**. His comment struck a chord with me and forced me to reconsider my long-standing perspective on this issue. Over the years, I have encountered countless students focused on obtaining the "right answer" or negotiating for extra marks, often with little interest in grasping the underlying chemistry. The phrase, *"Will this be on the exam?"* still echoes in my mind.

It was easy for me to see this as a student-sided problem of immaturity or entitlement or just lack of time. I realize now that the problem is much bigger and more complex than I had first imagined. Educators, students, and administrators alike are all part of a system that seems to prioritize grades over genuine learning, despite our rhetoric to the contrary. While grades and credentials are essential, our current assessment practices—often excessive and narrowly focused—appear to be a shared challenge across both chemistry and chemical engineering education. In fact, this issue is likely universal in higher education.

Before attending the workshop, I hoped to leave with practical solutions or at least some new strategies to enhance my teaching. Instead, I walked away with a deeper understanding of the similarities and differences between chemistry and chemical engineering education. Though the two disciplines are not the same and distinct in content and ethos, they are the same in that they face remarkably similar challenges when it comes to teaching and learning. Many of these challenges, such as practical work, scaffolding, content overload, and assessment-driven learning, have persisted throughout my 30-year career in education—and they will likely remain with us for some time.

Indeed, these challenges are complex but critical. How we address them will shape the future of education and the success of the next generation of students.

Teaching should be such that what is offered is perceived as a valuable gift and not as a hard duty.

— Albert Einstein

[1] Title inspired by Hoffmann, R. (1995). *The same and not the same*. New York, NY: Columbia University Press.

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52nd College Chemistry Canada Conference

Chemistry for All

Nunavut Arctic College
Nunatta Campus

Iqaluit, NU
29 May – 01 June 2026



Details for the 2026 College Chemistry Canada Conference can be found at the conference website.
Information will be continuously updated as planning progresses.

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