Chemical Engineering evolution asks for new educational strategies

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Modern Chemical Engineering emerged in the late 19th century in Great Britain, Germany, and the USA—then the world's most industrialized nations. Since its inception, the discipline has undergone profound transformations, gradually distancing itself from its original roots in Chemistry. A notable example is the emergence, in the early 1960s, of a new field—Biomedical Engineering—introduced by Peppas and Langer, and now widely referred to as Biological Engineering. Although focused on different subjects, this field still relies on the same fundamental tools of Chemical Engineering, such as mass, energy, and momentum balances. The growing demand for energy and the imperative for effective environmental protection—especially following the 1990 Kyoto Agreement—have further driven the diversification of Chemical Engineering into new areas, leveraging its inherent theoretical versatility. Today, the rapid development of Artificial Intelligence promises to introduce even deeper transformations to the field—changes that we can, at present, only begin to envision.

Considering these ongoing developments, a crucial challenge for chemical engineers is to ensure that students fully grasp the dynamic and evolving nature of the discipline—thereby dispelling the misconception of knowledge as something fixed and unchanging. To this end, the initial part of some of our courses is dedicated to exploring the historical evolution of Chemical Engineering. This approach helps trace the path that led to its status as one of the most versatile engineering disciplines. Our curricula also place strong emphasis on contemporary themes such as bio-based technologies, green energy, process-led and advanced functional materials, societal and environmental protection. These topics are presented through updated content that integrates concepts of sustainability and life cycle assessment. On the educational side, we have shifted the classical assessment paradigm by focusing more on the process students follow to arrive at a solution, rather than on the solution itself. This aims to foster problem-solving skills through a balanced integration of theory and practice. In this context, we have also expanded hands-on learning activities—laboratory work, simulations, and design projects—supported by the recent addition of highly qualified technical staff helping teaching activity.

Overall, we believe this renewed approach significantly strengthens our relationship with students, mitigates the adverse effects of their increasing emotional and cognitive fragilities, and enhances our role as mentors and facilitators of learning, rather than mere evaluators.

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