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The Human-Centric Lab: Pioneering Education 5.0 in Chemical Technology.

Scholarly Teaching and the Scholarship of Teaching and Learning

Innovative and Technology-Enhanced Learning and Teaching

Paper presentation oral

Abstract:

As the Fourth Industrial Revolution normalises automation, pedagogical frameworks must evolve toward Education 5.0—a paradigm that shifts focus from pure digitalisation to human-centric, purpose-driven technology integration. This keynote presentation, *"The Human-Centric Lab: Pioneering Education 5.0 in Chemical Technology,"* explores the critical intersection of advanced technologies and human ingenuity within chemical engineering education. Chemical technology presents unique pedagogical challenges, including severe safety risks, complex non-linear processes, and a pressing global mandate for sustainable "Green Chemistry." To address these imperatives, the presentation details practical implementation strategies for modernising the chemical technology classroom. Key interventions include deploying Immersive Reality (VR/AR) for zero-risk hazardous scenario simulations, utilising Artificial Intelligence and Machine Learning as "lab co-pilots" for predictive modelling and digital twins, and leveraging Internet of Things (IoT) sensors to create connected, smart laboratories.

Furthermore, the keynote examines the essential pedagogical shift required to support these technologies. Educators must transition from traditional knowledge deliverers to facilitators of innovation, emphasising ethical reasoning, complex problem-solving, and socio-emotional skills. While acknowledging implementation barriers such as infrastructure costs and faculty training, the address ultimately argues that Education 5.0 does not replace the physical laboratory; rather, it exponentially augments it. By strategically blending AI, XR, and IoT with experiential learning, educational institutions can graduate a new generation of chemical technologists who are not only digitally fluent and rigorously safe but also equipped to leverage human-machine synergy to solve humanity's most pressing environmental and industrial challenges.

Keywords: Chemical Education, pedagogy, teaching philosophy, problem-solving capabilities.

References

1. Gouws, Shawn, 2025/10/28, Book- ISBN 978-1-998959-18-1, CHASING CHALLENGES Scholarly Learning and Teaching for Chemical Process Technicians