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Contributed talk: Developing a systems thinking-based curriculum for catalysis education

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The extension of a holistic or 'systems thinking' approach to chemical education is a recent advancement [1]. Enabling students to appreciate the broader interconnections that chemical science shares with societal issues and other disciplines of study is paramount for chemistry to be a 'central science', particularly in the context of the UN Sustainable Development Goals that will shape the next decade [2].

While the first set of scientific publications (Special issue J. Chem. Educ., Vol 96, Issue 12, 2019) have identified ways to integrate systems thinking in general chemistry courses typically delivered to first-year University students, there is a necessity to embrace the same approach also in more advanced chemistry course modules, such as catalysis. Catalysis is undeniably an important tool in developing green and sustainable chemical processes, yet course units on catalysis have conventionally been taught through a reductionist perspective. This presentation identifies ways to transition to a systems thinking teaching style for catalysis courses. The analysis is built on the principle of constructive alignment with a focus on how intended learning outcomes, learning activities and student assessments will need to be modified to foster systems thinking [3]. Using diverse examples, the presentation will highlight how this rather seismic shift can be initiated through small incremental steps with minimal effort, eventually paving way to a full-fledged catalysis course grounded in systems thinking [3]. Furthermore, strategies to prevent disciplinary knowledge siloing and evolve beyond context-based catalysis instruction will be outlined [3]. Importantly, the presentation will illustrate how students can be stimulated to place environmental considerations at the forefront of their thinking instead of them merely acknowledging the environmental consequences of catalysis-related decisions.

[1] M.Orgill et al., J. Chem. Educ., 2019, 96, 2720-2729

[2] P. Mahaffy et al., J. Chem. Educ., 2019, 96, 2679-2681

[3] M. Ravi et al., J. Chem. Educ., 2021, 98, 1583-1593

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Author: RAVI, Manoj (University of Birmingham)

Presenter: RAVI, Manoj (University of Birmingham)

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