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Exploring sustainable development in chemical engineering practice: a Scoping Review and Keyword Co-occurrence Network

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Future engineers must be able to address critical sustainable development challenges. The capabilities to address these challenges are gained through engineering education. This aspect of engineering education requires both generalist and discipline-specific knowledge. Like all engineering disciplines, chemical engineering practice has a unique relationship to sustainable development. Understanding this relationship is vital to teaching sustainable development in chemical engineering education.

In this paper, we aim to answer the research question, “In Australia in the 2020s, what is the interaction between chemical engineering practice and sustainable development?”. We aim to articulate the relationship between current, acceptable Australian chemical engineering practice and sustainable development. This articulation will allow educators to teach sustainable development more effectively.

We performed a Scoping Review to explore the black and grey literature (e.g., websites, reports) discussing the interaction between ChE practice and sustainable development. Approximately 2,500 sources were initial identified, and around 400 were included in the review. A network of keyword co-occurrences was generated, and the keywords were qualitatively and quantitatively analysed.

The network contained 118 keywords automatically sorted into five clusters. The main sustainable development challenges discussed in the literature were water/ wastewater, energy, waste, the environment, and lifecycles/ circular economy. SDGs 4, 6, 7, 9, 12, and 13 were directly addressed in the network. The environmental and economic dimensions of sustainable development were well-discussed by the literature, but discussion on the social dimension is an opportunity for improvement in engineering communication.

This is the first Scoping Review of chemical engineering practice and sustainable development. Articulating this sustainable development-chemical engineering practice relationship will allow sustainable development to be meaningfully taught within

chemical engineering education. This will enable future chemical engineers to better contribute to solving sustainable development challenges.

Bio

Naomi Bury is a doctoral candidate in the Department of Chemical Engineering the Faculty's Teaching and Learning Laboratory at the University of Melbourne. Her engineering education PhD explores sustainable development in chemical engineering practice and education and is supervised by Prof. David Shallcross and Prof. Sally Male. Naomi uses qualitative and quantitative methodologies to explore the rich data of discipline-specific sustainable development knowledge through scoping reviews, focus groups and surveys.

In her PhD, she aims to articulate the relationship between chemical engineering practice and develop a framework of chemical engineering-specific knowledge on sustainable development. By combining these research outputs with her teaching practice, Naomi aims to prepare the next generation of chemical engineering graduates for the sustainability challenges they will face in their careers.