From Role-Play to Decision Support: Innovative Teaching of Industrial Ecology in Higher Education

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Abstract:

Teaching industrial ecology in higher education provides a unique opportunity to explore the complexity of sustainability challenges while equipping students with practical decision-making tools. The discipline is inherently interdisciplinary, addressing material and energy flows, socio-economic dimensions, and environmental impacts across scales. This multidimensional character makes it particularly well-suited to illustrate multi-criteria, multi-actor decision processes.

In our pedagogical approach, students work in groups that each represent a distinct stakeholder—such as industrial firms, local authorities, NGOs, or community organizations. Through this role-play, they must negotiate, justify, and defend their priorities while considering the broader system implications. The exercise culminates in a scenario analysis where groups collectively design and simulate an actor of an industrial symbiosis. Decision support methods, such as multi-criteria analysis, are introduced to structure trade-offs and to make explicit the tensions between environmental, economic, and social objectives.

This experiential format fosters not only technical knowledge but also soft skills such as negotiation, systems thinking, and collaborative problem solving. Students gain a tangible understanding of how industrial ecology can guide sustainable transitions, while also appreciating the challenges of collective decision-making in real-world contexts. The approach thus demonstrates the strong pedagogical potential of industrial ecology for training future engineers.

Keywords:

Industrial ecology, multicriteria decision making, stakeholder role-play.