BinBin J. Pearce
ETH Zurich

Integrating Systems and Design Thinking (INSYDE) for Complex Problem Solving in Environmental Systems Science

Integrated design and systems thinking (INSYDE) is an approach for framing and solving ill-defined problems (Dörner 1989; Dörner and Funke 2017; Rittel and Weber 1973) in real-world settings. The aim of INSYDE is to enable students to understand the complexity of the world around them, but also to empower them to innovate for a better future. These are transferable skills for a new world.

The methodology has been implemented in a year-long, interdisciplinary environmental systems science course for Swiss university, “Tackling Environmental Problems”. This approach was applied in sustainable infrastructure projects in Switzerland (i.e., gravel mining in the canton of Zurich, sustainable construction in Switzerland). Since implementation, we have observed students acquiring transferable skills, such as being able to: 1) Tap into both cognitive reasoning and affective judgements to identify insights, 2) Frame problems from diverse stakeholder points of view, at various organizational scales, 3) Develop concrete strategies for working with unknowns and uncertainty following and 4) Collaborate in small groups under time pressure to create a viable solution to a complex problem. INSYDE integrates design thinking (Arnold 2016; Brown 2018; Buchanan 1992; Cross 200) and systems dynamics (Frischknecht and Schmied 2009; Midgley 2000; Vester 1988) based on multimodal means of inquiry (scientific literature, expert interviews, site visits), the creation of problem statements from specific stakeholder perspectives, and an iterative search for solutions with attention focused on systemic implications. The learning setting adapts problem-based learning (Hmelo-Silver 2004; Weber 2004) to learning objectives as a part of a transdisciplinary learning framework developed at ETH Zurich (Hirsch Hadorn et. al 2008; Lang et. al 2012; Pearce et. al 2018). We compare the outputs of the students in the form of written artefacts and physical prototypes to assess the degree to which learning objectives in this transdisciplinary learning framework have been met.

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