Learning Objectives

Sustainable Development

Foundational Knowlege

1.1 | Remember the Brundtland Report definition of sustainable development;

1.2 | Understand that the term "sustainable development" has many interpretations;

1.3 | Remember that proactive prevention of (environmental, societal, or economic) damage requires far fewer resources than reactively attempting to reverse damage after it has occurred;

1.4 | Understand that sustainable design addresses societal, economic and environmental concerns in an integrated (or holistic) way; designs that address less than all three are unlikely to be sustainable;

1.5 | Remember that economies ("the trade of goods and services") are wholly-owned subsidiaries of societies, both of which require a healthy environment to thrive;

1.6 | An activity will not be sustainable unless A) its effective consumption of resources is less than the environment's ability to regenerate those resources and B) it functions to increase societal equity;

1.7 | Identify the strengths and limitations associated with the following decision-making tools: Life-cycle assessment, ecological footprint, design for environment;

1.8 | Sustainable development indicators are locally-defined;

1.9 | Sustainable development indicators derive from social, environmental and economic measures;

1.10 | Sustainable solutions rely on local resources;

1.11 | Sustainable development implies a shift in thinking from "economy of scale" to "economy of scope";

1.12 | A minimum set of sustainable development indicators must include indicators for ***1.*** sufficiency of real human well-being for all and ***2.*** sustainability of environmental integrity, and ***3.*** the ratio of the two, which measures the efficiency of converting natural capital to real human well-being.

Application

2.1 | Use causal loop diagram to approximate the behavior of a complex system;

2.2 | Identify appropriate sustainable development indicators for a system;

2.3 | Select the right method to evaluate the sustainability of products, processes or services from system perspective;

2.4 | Define a design problem from a systems view (e.g., The need to relocate an company's office buildings may be more of an issue of transmitting information instead of creating a new location for people to meet);

2.5 | Identify leverage points within a system that can serve to make the system more sustainable;

2.6 | Create innovative solutions (strategies, designs, consumption patterns, policy) that have the potential to make the system more sustainable;

2.7 | Learn to set sustainable development goals and select appropriate indicators and methods to monitor sustainability performance of a system;

2.8 | Learn to dynamically model a simple system using causal loop diagram, stock-flow diagram and make sustainable decisions;

2.9 | Learn how to manage campus sustainable development projects with application of all above thinking.

> **What impact do I want this module experience to have on students, that will still be there a year or more after the course is over?**

Integration

3.1 | Through research, determine how natural systems and social systems are linked to one another through stocks and flows;

3.2 | Recognize the connection between sustainable development and topics such as system thinking, population, water, material and energy;

3.3 | Identify sustainable indicators that have a local and global relevance;

3.4 | Relate the concept of sustainable development to their own behavior and decisions;

3.5 | Develop a set of sustainable development indicators for their lives;

3.6 | Describe the importance of environmental integrity (species diversity, health of ecosystem) to real human well-being.

Human Dimension

4.1 | Understand both sides of the sustainable development balancing equation (capacity of the natural system and demands of the social system) can be altered significantly by human actions and their impact on the local environment, global environment, and community;

4.2 | Understand their role in sustainable development;

4.3 | Understand that one's own view of the world results from mental models where facts are ascribed personal meaning only represents part of the whole situation and is biased by one's mental models;

4.4 | Appreciate others' views on sustainability and see a situation from another's perspective;

4.5 | Sustainable solutions require the consideration of all peoples' aspirations and the collaboration with others;

4.6 | Awareness and reflection on mental models facilitates sustainable design.

Caring

5.1 | Feel they are important and "part of the solution" for sustainable development;

5.2 | View the field of engineering as one of tackling challenges caused by the global economic system (i.e., as a field with a high human purpose);

5.3 | Value the perspectives brought by other disciplines in solving sustainable development challenges;

5.4 | Care about their community (e.g., campus), environment.

Learning How to Learn

6.1 | Familiarize with Internet resources related to local and global issues of sustainable development;

6.2 | Identify a problem related to sustainable development in their community that they have a passion;

6.3 | Identify resources to get information for solving the problem from 6.2;

6.4 | Solve the problem by synthesizing information found through self-directed learning in 6.3;

6.5 | Practice the virtues of inquiry and critical thinking when evaluating new information: ***1.*** Intellectual integrity ***2.*** Intellectual humility ***3.*** Confidence in Reason ***4.*** Intellectual Perseverance ***5.*** Fairmindedness ***6.*** Intellectual Courage ***7.*** Intellectual Empathy ***8.*** Intellectual Autonomy ***9.*** Develop a metacognitive awareness of their own thinking process (how their biases enter in the selection of data and reasoning).