



Engineering Systems Doctoral Seminar

ESD.84 – Fall 2002

Session 2

September 11, 2002

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Session 2: Overview

- Welcome and Overview and Introductions (5-10 min.)
- Engineering Systems Learning Center Overview (5-10 min.)
- Syllabus Analysis and Dialogue (30-45 min.)
- Book Reviews (10-15 min.)
- Break (15 min.)
- Historical Perspective on Engineering Systems as a Field (30-45 min.)
- Analysis of Uncertainty and Complexity as Core Concepts (20-30 min.)
- Next Steps (10-15 min.)

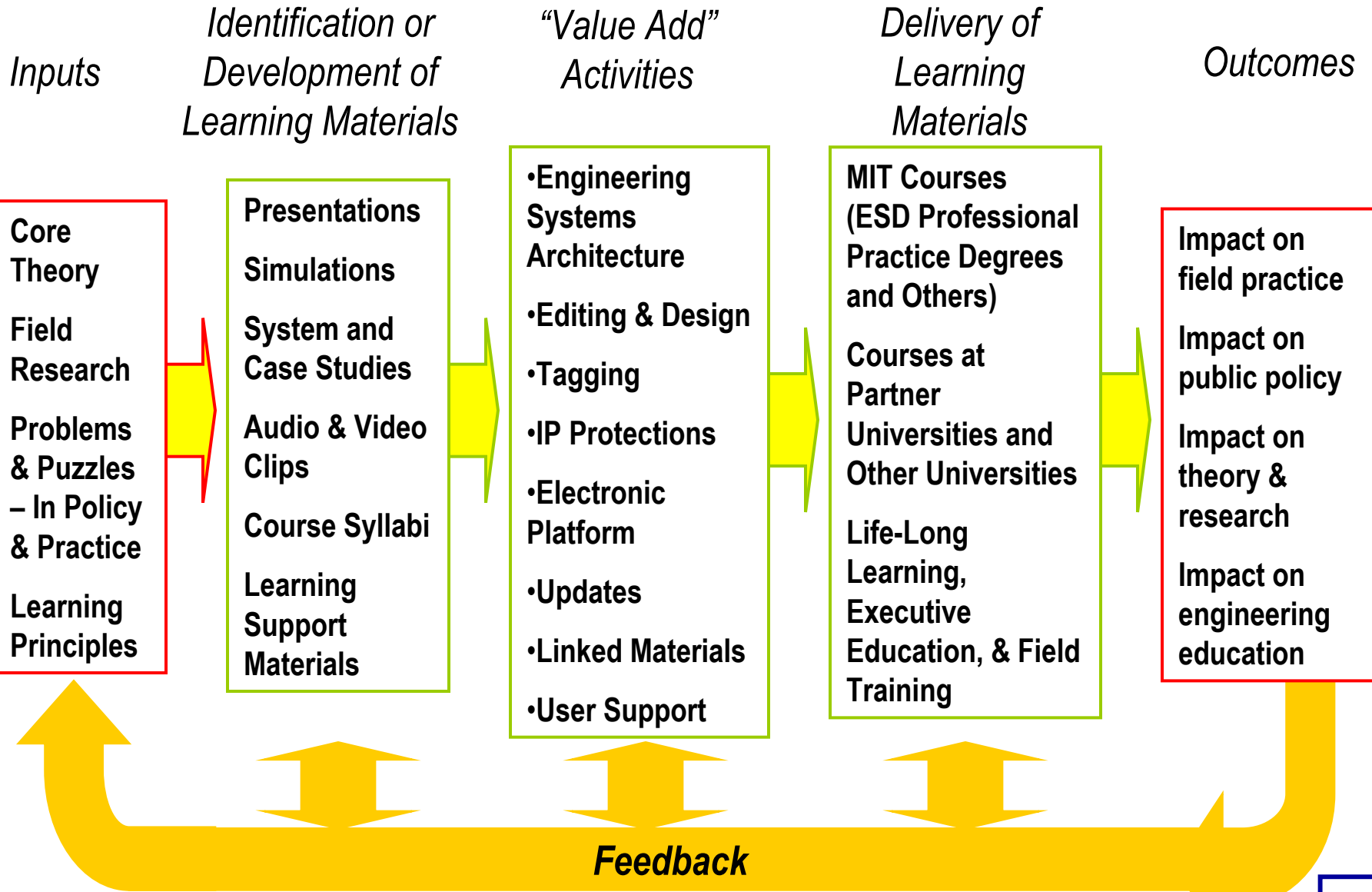


Engineering Systems Learning Center Overview

- Advancing Engineering Systems as a Field
 - Conceptual “map” of the field – intellectual architecture for materials
 - Transmission of research findings into education, practice and policy
- Transforming Engineering Education
 - Interactive, multi-perspective approach to learning about complex systems
 - “System studies” as a signature product
- Learning Materials
 - Modular, scalable, and regularly updated
 - Designed for use in the classroom, workplace, and distance/e-learning formats
- Target Audience(s)
 - MIT faculty
 - Faculty at partner universities
 - Instructors in industry and government operations
 - Learners interested in Engineering Systems



ESLC Value Stream





Engineering Systems: Key Concepts from ESLC Intellectual Architecture

- Engineering Systems Theory, Design, Architecture and Methods
 - Defining systems
 - System characteristics (including all of the “ilities”)
 - Systems models and types
 - Systems thinking
 - Systems engineering
 - Systems dynamics
 - Systems design and architecture
 - General systems theory
 - Complex adaptive systems and complexity science
 - Socio-technical systems theory
 - Systems analysis and cybernetics
 - Optimization in complex engineering systems
 - Uncertainty and decision theory in complex engineering systems
 - Accidents in complex engineering systems
 - Agent models, genetic algorithms and evolutionary theory
 - The mind, brain and complex biological systems
 - Time and complex engineering systems
 - Systems methods and tools



Engineering Systems: Key Concepts from ESLC Intellectual Architecture (cont.)

Socio-Technical/Enterprise Engineering Systems by Discipline and Sector

- Aerospace engineering systems
- Chemical and bio-chemical engineering systems
- Civil and environmental engineering systems
- Electrical and computer engineering systems
- Material science engineering systems
- Mechanical engineering systems
- Nuclear engineering systems
- Ocean engineering systems

Socio-Technical/Enterprise Engineering Systems by Application

- Lean enterprise systems
- Production systems
- Product development systems
- Supply chain systems
- Information systems
- Financial and accounting systems
- Software development systems
- Sustainment systems
- Recycling systems
- Regulatory systems
- Global systems
- Systems management
- Systems change
- Social systems interdependent with technical systems





Syllabus Analysis and Dialogue

- Syllabus Decomposition
 - Level 1: Topics – Fall 2002 and Spring 2003
 - Level 2: Guests for each topic
 - Level 3: Faculty, guest and student presentations for each topic
 - Level 4: Readings for each topic
 - Level 5: Assignments
 - Level 6: Logistics
- Syllabus Integration
 - Role in Ph.D. programs
 - Role in the future of ESD
 - Role in future career success



Uncertainty and Complexity

- Step 1:
 - Form two groups – half the class focusing on “uncertainty” and half focusing on “complexity”
- Step 2:
 - Brainstorm different metrics and methods for assessing the degree of “uncertainty” or the degree of “complexity” of engineering systems
- Step 3:
 - Assess the list – here are sample assessment questions:
 - Are the metrics and methods idiosyncratic to specific systems?
 - Are the metrics and methods easy or difficult to apply?
 - Where are these methods and metrics used and where could they be used?
- Step 4:
 - Be prepared to report out our findings for full group discussion