DYNAMIC SYSTEMS THINKING and MODELING: Graphic

Interdependent Systems Processes—Self-Reinforcing

THINKING ⟷ **COMMUNICATING** ⟷ **LEARNING**

Mental Models are selective abstractions. All Mental Models are wrong. Some are useful!

Consists of two activities

Constructing Mental Models | **Simulating Mental Models**

Two Sub-activities (fundamental)

Selecting | **Representing**

Fundamental Questions

What to include? | How to represent? | How do they relate?

Cannot proceed until mental model is available

Have actual outcomes

Two Questions:
1. Horizontal – how broadly to cast the net?
2. Vertical – How deeply to drill

- Cause & Effect Loops
- NOT linear/causal (factors independent & run one way

Making available for scrutiny by others

1. Thinking outputs are the raw material
2. Feedback after scrutinizing each other's mental models
3. Associated Simulation Outcomes

Bootstrapping Learning
Stocks and Flows allow free movement across disciplinary boundaries

Mental Model Changes
- Self-Reflective Learning (Thinking process)
- Other Inspired Learning (Communication Process)

Learning is the Bottom Line to the interdependent triumvirate

Cultural Evolution

Closing the Learning Loop
1. Learning captured & stored
2. Outside the bodies of creators/users
3. Collective understanding transcends individuals
4. Ratcheting understanding because it is housed extra-corporeally

An organizational learning infrastructure. A set of Stella Models.

Simulating Stocks & Flows
- Visual
- Operational

Listening
Learning
Empathizing

Icon Based Lexicon

Stocks	Flows
things & states of being	what causes change

Content-independent to speak/write fluently)

To 4 Operational Thinking

Process: Operational Thinking
1. Modeling predicts what will occur (qualitative not quantitative)
2. Monitor actual outcomes vs. model generated predictions
3. Discrepancies? Scrutinize model and adjust overtime.

8 SYSTEMS THINING SKILLS

1 — 10,000 Meter
- Big Picture

2 — Systems as Cause
- Self-generating elements
- No external forces
- Counters vertical bias

3 — Filtering
- Non-essential elements of reality

5 — Closed-loop Thinking
- Feedback loops
- Non-linear behavior patterns
- Natural & social systems

6 — Non-linear Thinking
- Capture delay
- Waxing & waning

7 — Scientific Thinking
- Rigorous simulation practices

8 — Empathizing
- Capacities needed to realize synergies latent within multiple discipline curriculum
- Increases listening & articulating communication

4 — Operational Thinking

Stella Software – Internalizing the associated 8 Systems Thinking Skills as well as language & method (Conceptual not Mechanical)

Graphic designed by Cheryl Genet, with accompanying description
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based on *An Introduction to Systems Thinking* by Barry Richmond