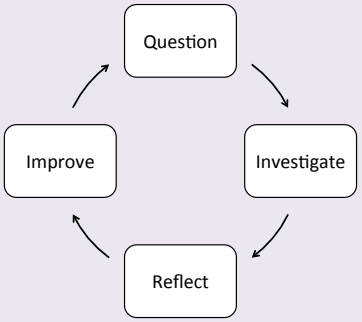
Evaluation Capacity Building in a Complex Adaptive System:
Studying Complexity Theory as a Framework for Understanding ECB in a Network

Frances Lawrenz, Jean King, Amy Grack Nelson, Molly Illes, Gayra Ostgaard Eliou[1] Marjorie Bequette, Al Onkka, Lauren Causey, Sarah Cohn[2]
Christine Reich, Liz Kunz Kollmann, Stephanie Iacovelli, Juli Goss[3] Scott Pattison, Chris Cardiel, Anne Sinkey, Melanie Francisco[4]
[1]*University of Minnesota,* [2]*Science Museum of Minnesota,* [3]*Museum of Science, Boston,* [4]Oregon *Museum of Science & Industry*

ECB Model: Team-Based Inquiry

An approach to empowering education professionals to get the data they need, when they need it, to improve their products and practices.



Our Case: The NISE Network System

A national community of researchers and informal science educators dedicated to fostering public awareness, engagement, and understanding of nanoscale science, engineering, and technology.

Evaluation Capacity Building Theoretical Framework*

Individual and organizational characteristics
- Skills and knowledge
- Positive attitude/appreciation
- Using evaluation information (systems for use)
- Systems for sustainability

F*actors affecting evaluation capacity building*
- Professional development
- Organizational resources and support
- Organizational environment: interest; buy-in and systems for use

Complex Adaptive Systems Theoretical Framework*

Attributes related to behaviors within a complex adaptive system
- Nonlinear; Adaptation/ Evolves; Uncertainty; Reproductive instability; Randomness; Dynamic/Far from equilibrium; Dynamical change; Positive and negative feedback loops; Emergent; Stability under perturbations

Attributes related to the agent structure within the system
- Coherence; Internal diversity; Internal redundancy; Neighbor interactions

Attributes related to the overall structure of a complex adaptive structure
- Decentralized control; Nested structure; Open system; Massively entangled

Research Questions

1. What is the nature of NISE Network participants' experiences with team-based inquiry (TBI)? Given the diversity of participants, in what ways does TBI change (if at all) for different audiences?
2. To what extent and in what ways does the TBI initiative promote evaluation capacity for case study participants and widespread evaluation capacity building within the NISE Network?
3. What conditions from the perspective of complexity theory appear to foster or impede evaluation capacity building among case study participants and across the Network?
4. To what extent does complexity theory provide insights on the NISE Network's evaluation capacity building?
5. Beyond complexity theory, what fundamental elements of TBI are critical for ECB, including factors that support ongoing use and learning transfer?

Approach & Methods

- Multiple case study approach, focusing on the four NISE Net workgroups featured in the graphic above.
- Collected data about each workgroup through observations, interviews, and artifacts.
- Conducted cross-case analysis using NVivo.
- We also mapped the involvement of individuals in each workgroup through social network analysis.

ECB Related Findings

- There was existing support within the NISE Network, even before the introduction of TBI, for evaluation.
- Through the NISE Network, individuals became very comfortable with evaluation.
- Evaluation activity in the Network can occur as the result of one person's leadership, group members working individually, or through collaborative effort.
- Individuals in the NISE Network have different conceptions of TBI and its use.

ECB ←→ CAS Related Findings

- The NISE Network has structures and mechanisms that allow for both stability and adaptability.
- Feedback loops connect evaluation capacity building with the complexity of the system.
- There is a balance within the Network between diversity and redundancy, as well as centralized and distributed control.

This work was supported by the DRL program of the National Science Foundation under the award number 1228868.

CAS Related Findings

- Individuals are involved in the Network in diverse ways.
- There are multiple connections among people who participate in the four working groups.
- The NISE Network exhibits characteristics of both decentralized (distributed) and centralized (hierarchical) control.
- The NISE Network has evolved and adapted since its inception.

*See handout for references to the literature that informed the ECB and CAS theoretical frameworks.