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The Evolution of HELIX: A Competency Model for Complex Problem Solving

www.incose.org/symp2021

Motivation – focused development of these skills

World Economic Forum Top 10 Skills Survey Results

Most In-Demand Skills of 2015	Most In-Demand Skills of 2020	Most In-Demand Skills of 2025
1. Complex Problem Solving	1. Complex Problem Solving	1. Analytical Thinking & Innovation
2. Coordination with Others	2. Critical Thinking	2. Active Learning & Learning Strategies
3. People Management	3. Creativity	3. Complex Problem Solving
4. Critical Thinking	4. People Management	4. Critical Thinking & Analysis
5. Negotiation	5. Coordination with Others	5. Creativity, Originality & Initiative
6. Quality Control	6. Emotional Intelligence	6. Leadership & Social Influence
7. Service Orientation	7. Judgment & Decision Making	7. Technology Use, Monitoring & Control
8. Judgment & Decision Making	8. Service Orientation	8. Technology Design & Prototyping
9. Active Listening	9. Negotiation	9. Resilience, Stress tolerance, Flexibility
10. Creativity	10. Cognitive Flexibility	10. Reasoning, Problem-solving, Ideation

complex **problem solving** capabilities

collaborative **learning** and leadership capabilities

personal **learning** & self leadership capabilities

Foundations

Definitions

- **Complex problem solving** is a collection of processes and activities related to cognitive, emotional, and motivational aspects of self, applied to dynamic situations, to achieve ill-defined goals. [Dörner and Funke 2017]

- **Active Learning** is the way in which we regulate the flow of energy and information over time in the service of these goals. [Crick et al. 2015]

- Active learning and complex problem solving are together the core to understanding the **dynamics** of a system and acting upon them.
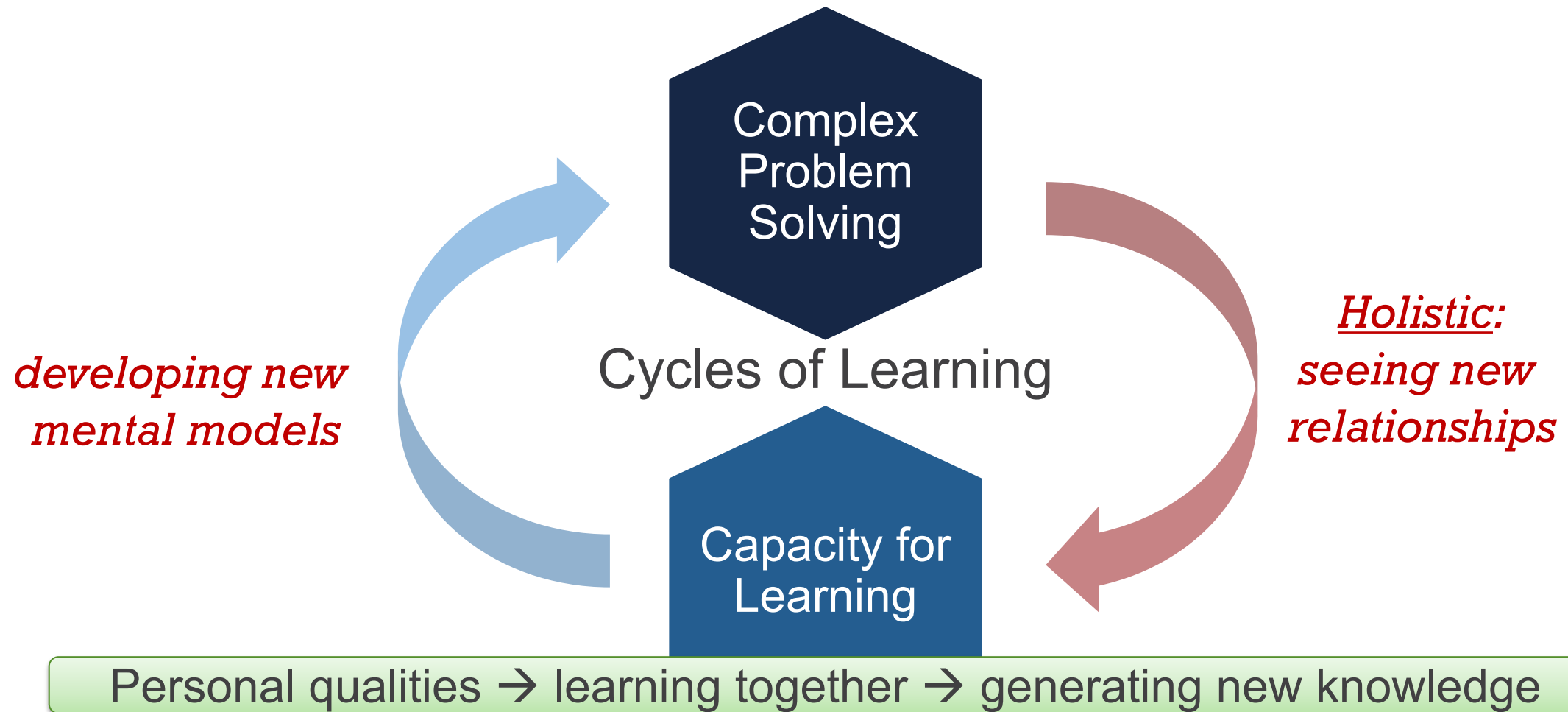
Continually developed across a career
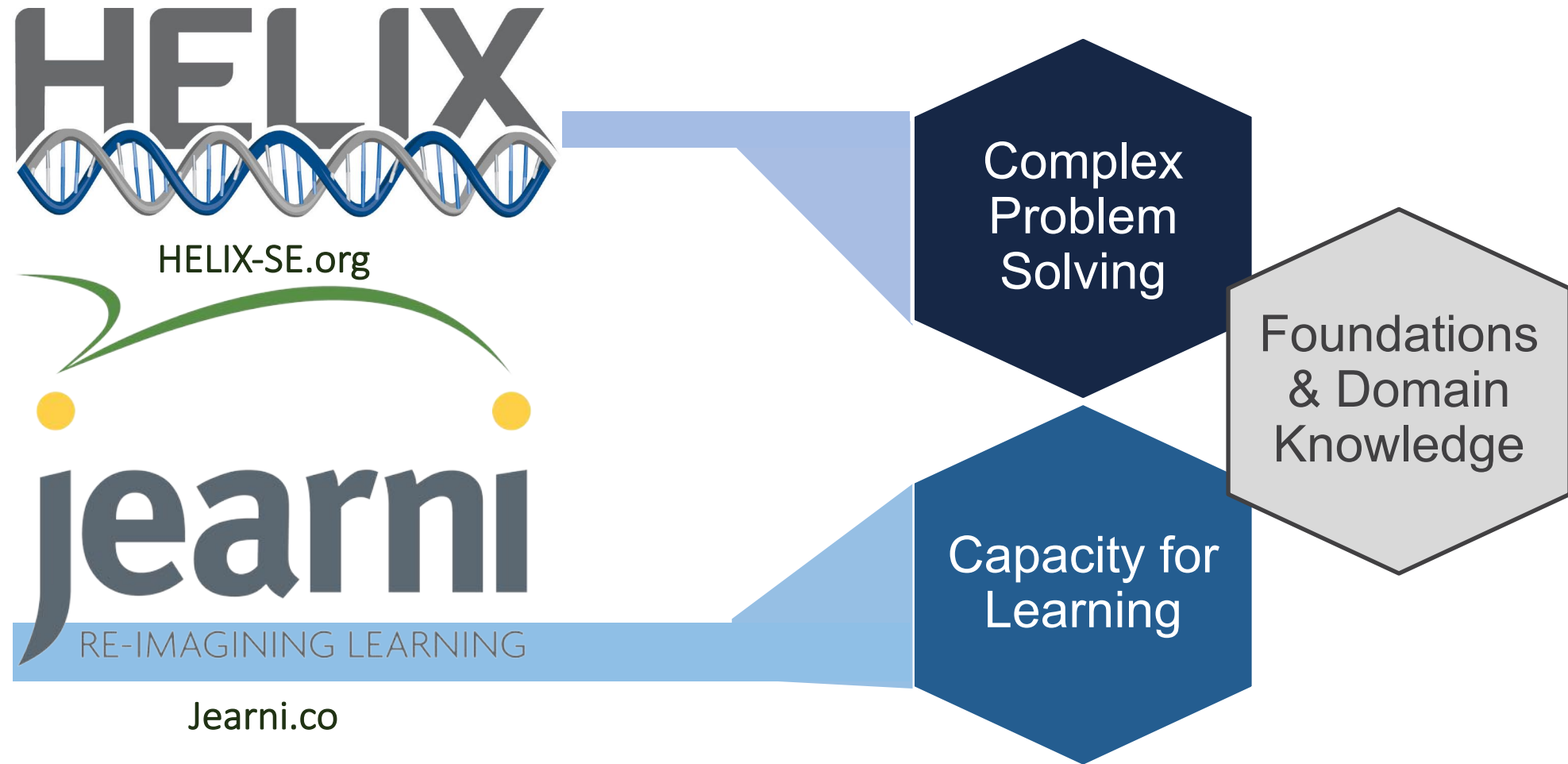
Applied in a project, role, situation
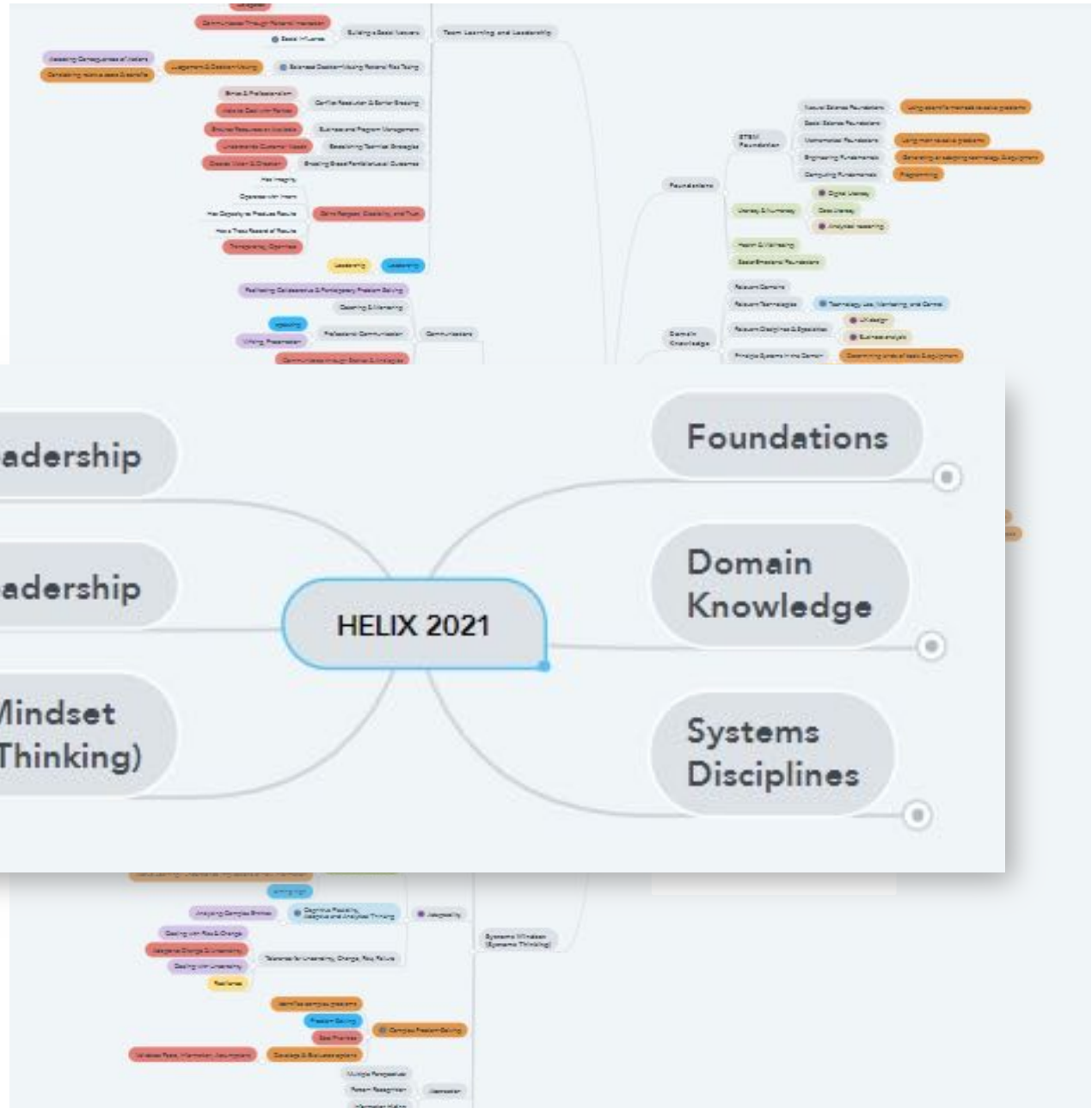
Producing an outcome

Can we assess and train individuals and organizations?

developing new mental models

Complex Problem Solving

Cycles of Learning

Capacity for Learning

Holistic: seeing new relationships

Personal qualities → learning together → generating new knowledge

Integrating Two Assessment Frameworks

HELIX-SE.org

Jearni.co

Complex Problem Solving

Foundations & Domain Knowledge

Capacity for Learning

Generalization

What is HELIX? (Helix-SE.org)

Foundational Skills

Personal Learning and Self-Leadership

Forces

Systems Knowledge and Experience

Complex Problem Solving

Domain Knowledge and Experience

Collaborative Learning and Team Leadership

HELIX is a workforce **proficiency framework** for **individual** and **organizational** effectiveness, based on a study of complex problem solving in systems engineering.

HELIX contains **proficiency** and **career tracking toolsets** focused on individual total person development. HELIX also contains an **organizational tool assessment tool** focused on generative culture, organizational self-awareness, and **FORCES** that create individual effectiveness.

HELIX evolved from a long-term study of the proficiencies of systems engineers facilitated by the Systems Engineering Research Center (SERC) at Stevens Institute of Technology. It represents the most comprehensive study of engineering effectiveness ever undertaken.

What is Learning Power? (Jearni.co)

Mindful Agency · Sense Making · Creativity · Curiosity · Belonging · Collaboration · Hope & Optimism · Open to Learning

Learning Power

Forming Purpose → Using Learning Power → Generating Knowledge → Evaluating Performance
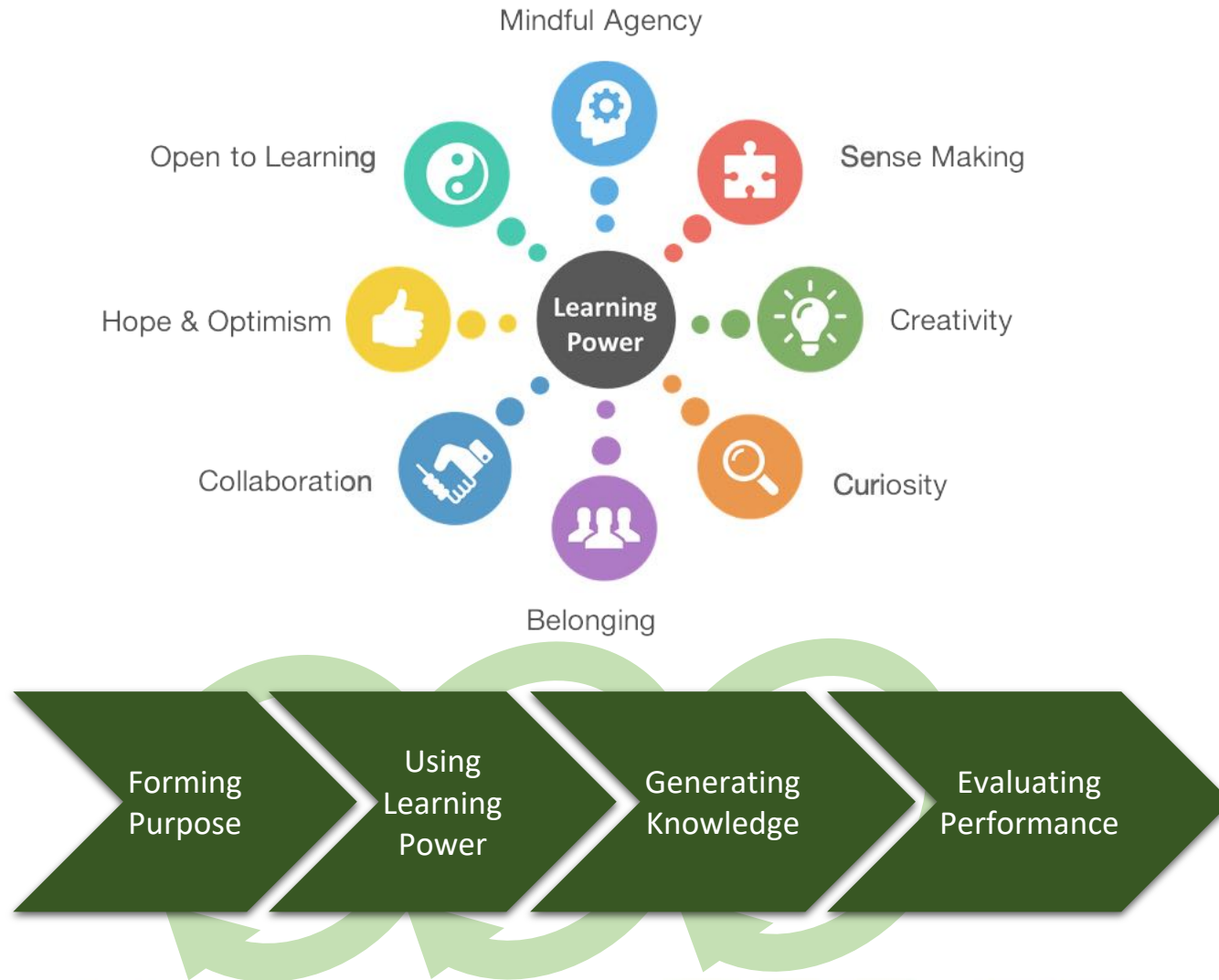
A **Learning Power** self-assessment provides a language and research-based measurement model focused on **self-diagnosis**, **learning capacity**, and **strategies for change**.

Reflection on our **Learning Power** enables us to develop awareness, ownership and responsibility for our **learning journeys** in all aspects of our lives – both as individuals and members of a team, an organization or a community.

Learning Power fuels complex problem solving, critical thinking and creativity, all key competences for wellbeing and success in our world. Understanding ourselves as learners enables us to 'get better' at self-directed learning.
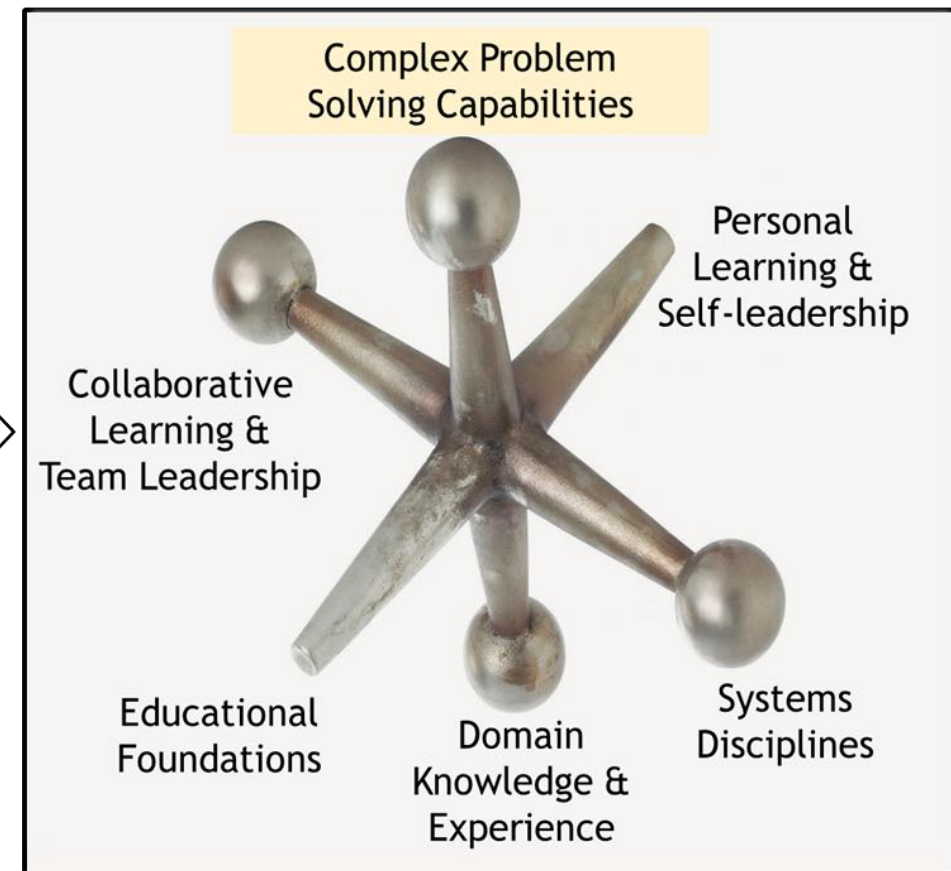
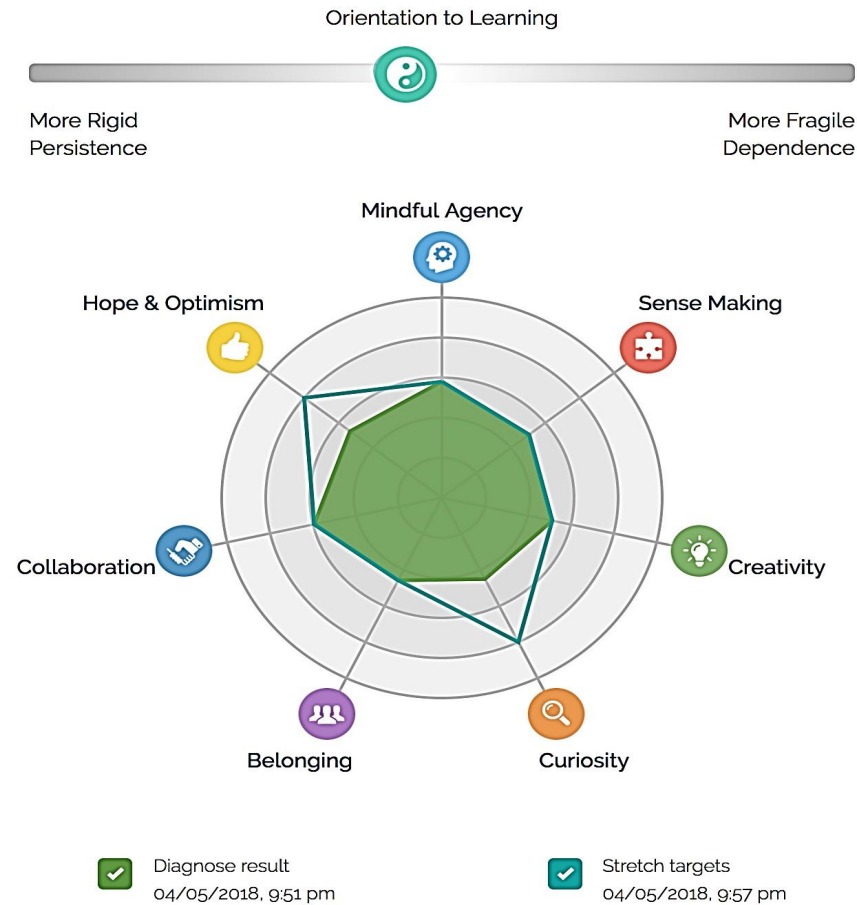# Generalizing HELIX – the "Jacks" Model
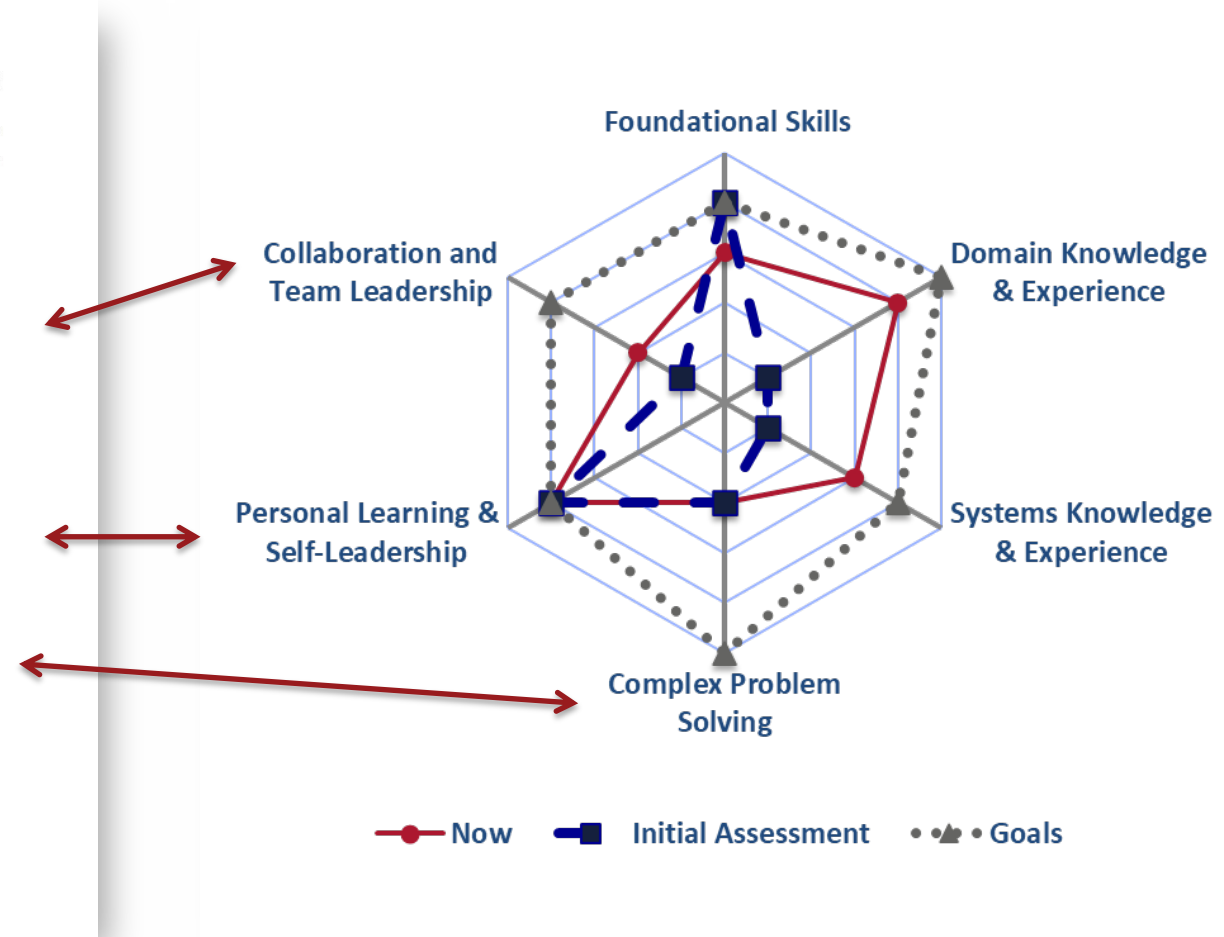
Atlas 1.1
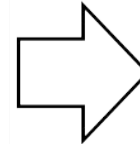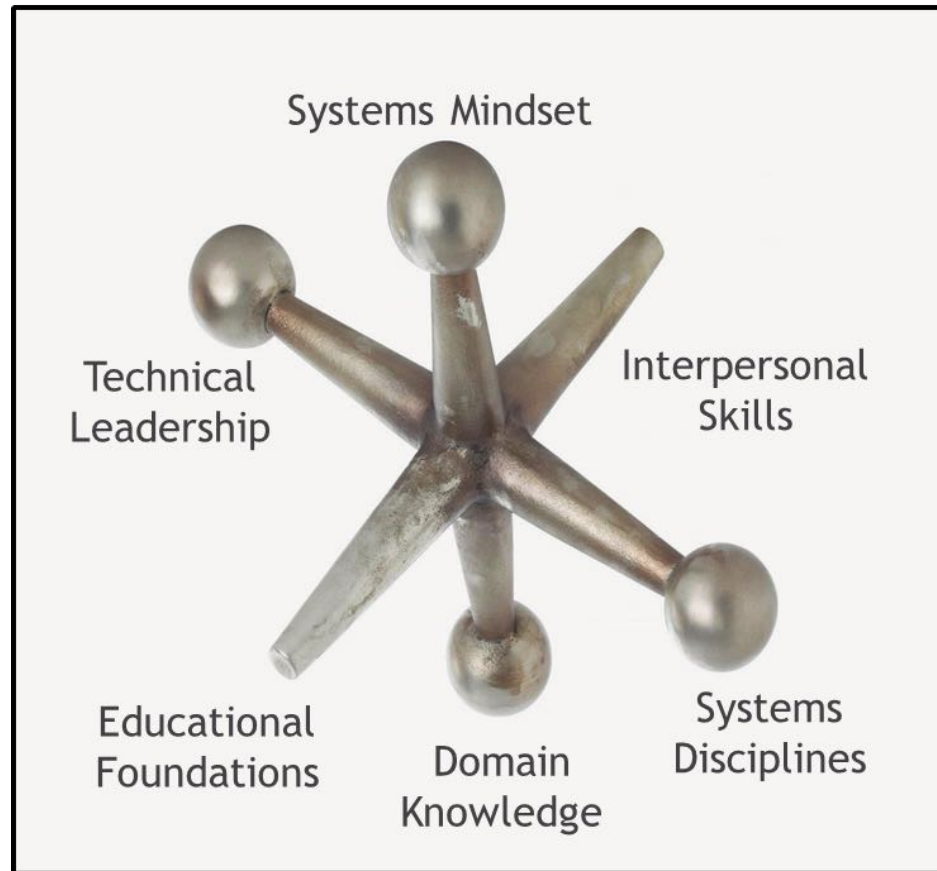
Generalized Model

Individual Assessment Frameworks

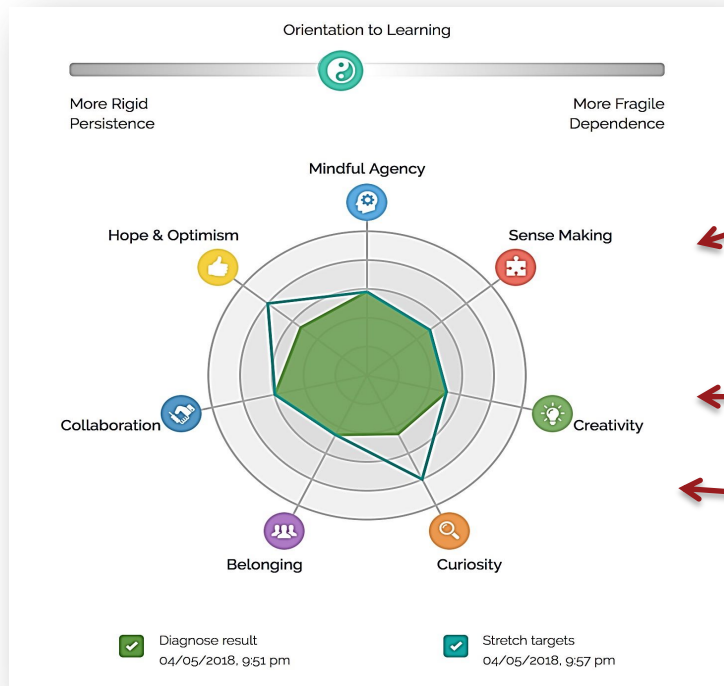
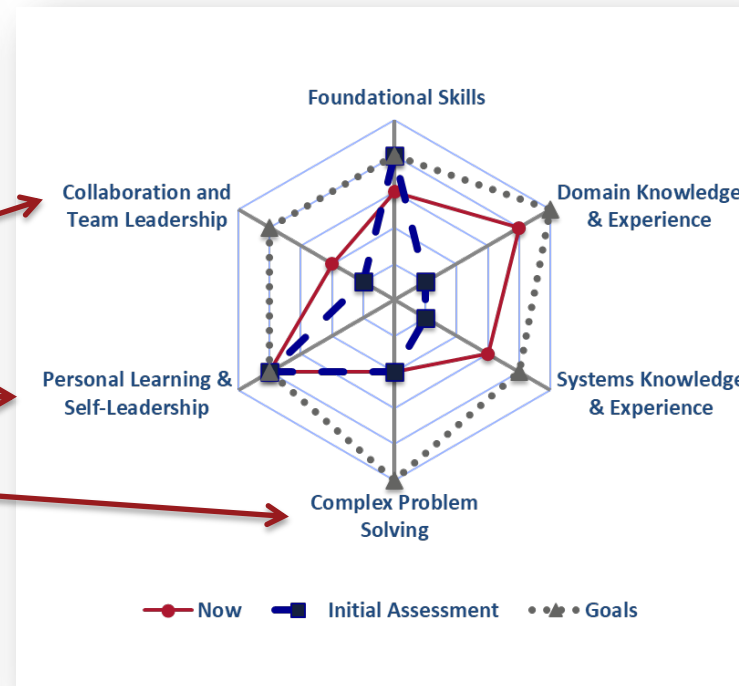Capacity for Learning

Complex Problem Solving

Balanced Training Regime

Assessments:

Jearni.co

HELIX-SE.org

Training programs:

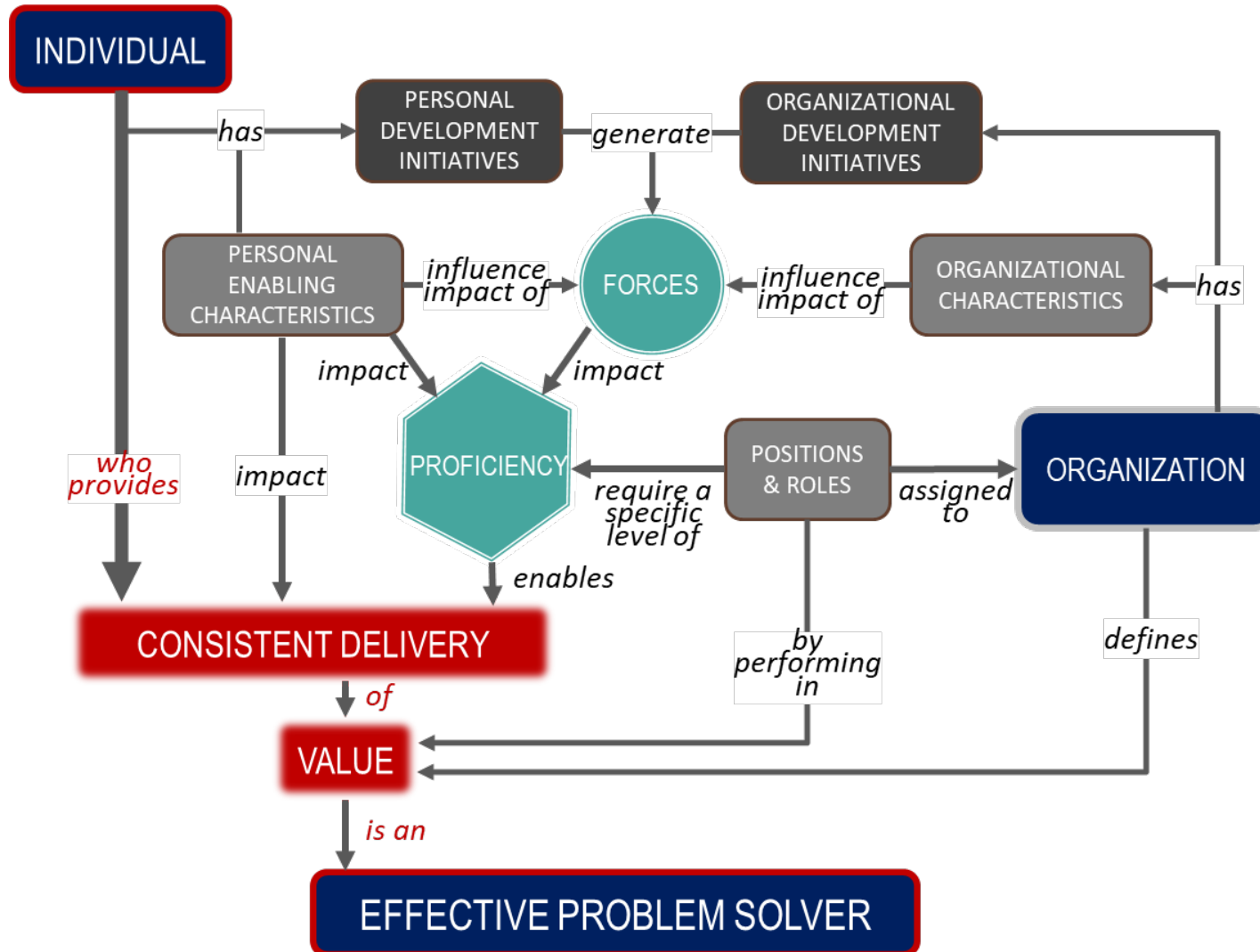- Leadership
- Systems
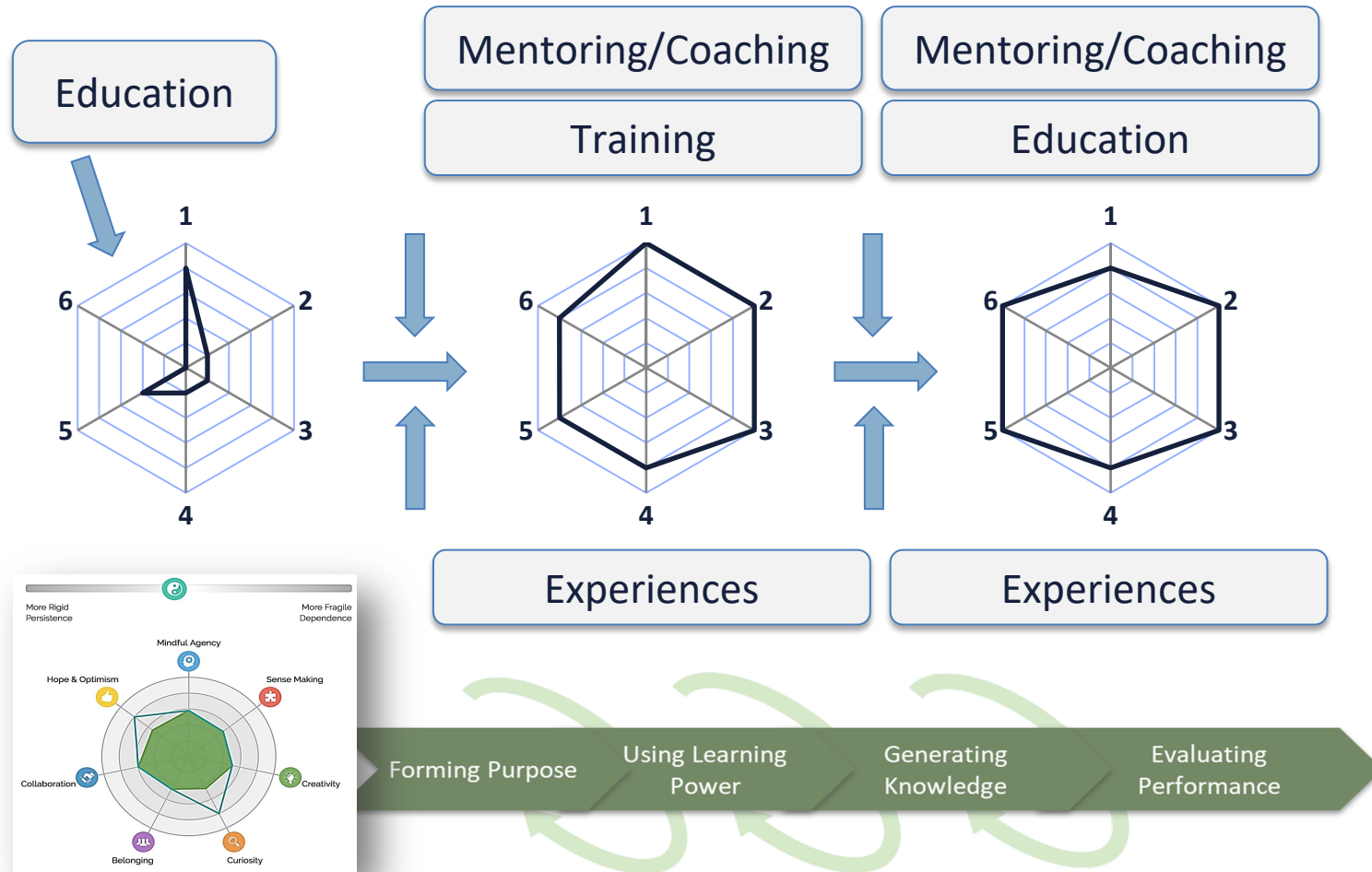- Domains
- Foundations
- Self

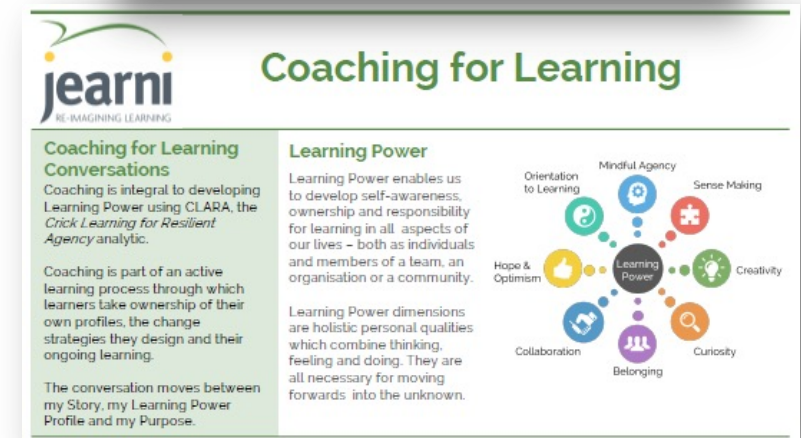# HELIX - Creating an Environment

- Individual & organizational **forces** create the environment for active learning and complex problem solving
- Supported by individual **incentives** & organizational **opportunities**
- Producing **value** to the individual & organization

Individual Developmental Framework

Education

Mentoring/Coaching

Training

Mentoring/Coaching

Education

Experiences

Experiences

Forming Purpose → Using Learning Power → Generating Knowledge → Evaluating Performance

HELIX: Career Path Assessment
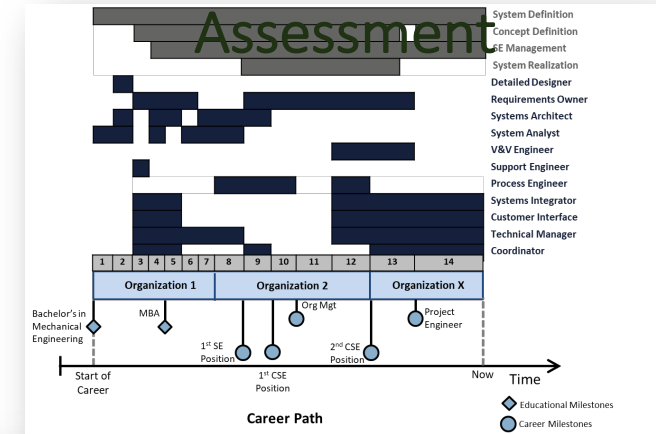
Jearni: Coaching Triads

Generative and Adaptive Organizations

*Can we assess and train individuals and **organizations**?*
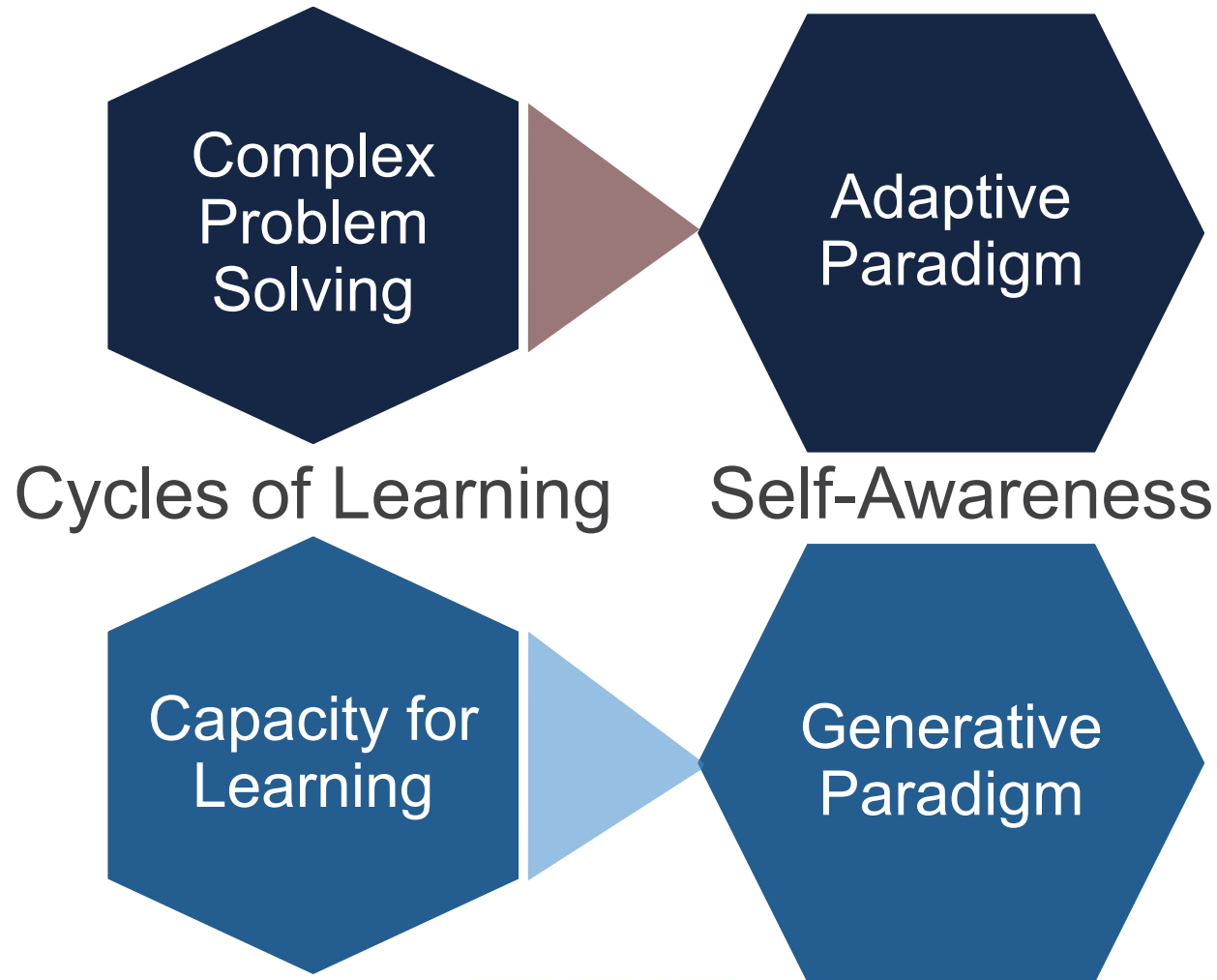
Complex Problem Solving

Adaptive Paradigm

Cycles of Learning

Self-Awareness

Capacity for Learning

Generative Paradigm

Adaptive Paradigm: make the enterprise more resilient, scalable and efficient.

Generative Paradigm: generate new value. In a world of constant change and rising competitors, you have to create new value just to stay even.

Text credits: Tom Mohr - In the Loop
https://medium.com/ceoquest-in-the-loop/home

HELIX Organizational Assessment

Teams Solve Problems Faster When They are More **Cognitively Diverse**

Qi Quality of interaction   humaninsight

OPPOSITIONAL	**GENERATIVE**
Cautious	Curious
Controlling	Encouraging
Flexible	Experimental
Hierarchical	Forceful
Reasoned	Inquiring
Resistant	Nurturing
DEFENSIVE	**UNIFORM**
Cautious	Appreciative
Conforming	Considered
Controlling	Controlling
Directive	Competitive
Hierarchical	Flexible
Resistant	Hierarchical

COGNITIVE DIVERSITY — High / Low

Low — High
PSYCHOLOGICAL SAFETY

https://hbr.org/2018/04/**the-two-traits-of-the-best-problem-solving-teams**

Psychological safety is the belief that one will not be punished or humiliated for speaking up with ideas, questions, concerns, or mistakes

Teams Have Differing Beliefs and Assumptions about what drives **Value and Effectiveness**

FLEXIBLE

LONG-TERM DEVELOPMENT   BREAKTHROUGH

COLLABORATE (CLAN) — *Do things together*

CREATE (ADHOCRACY) — *Do things first*

INTERNAL — EXTERNAL

CONTROL (HIERARCHY) — *Do things right*

COMPETE (MARKET) — *Do things fast*
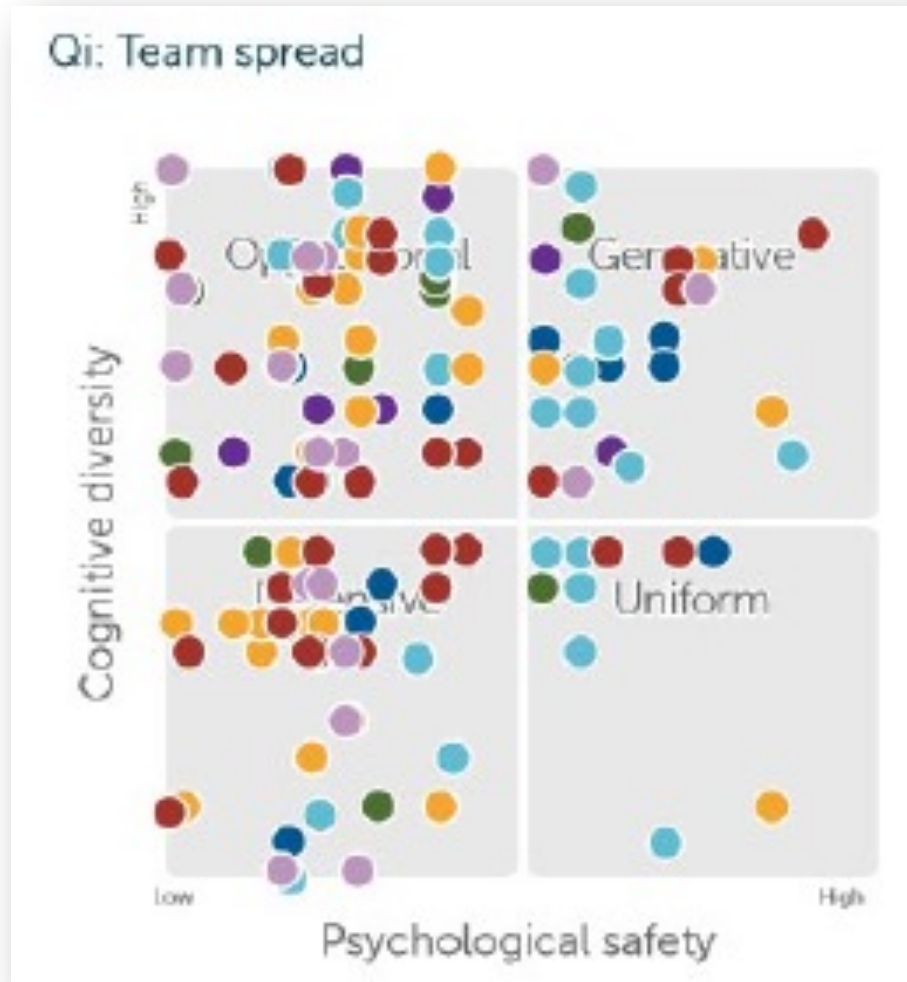
INCREMENTAL   SHORT-TERM PERFORMANCE

FOCUSED

Cameron & Quinn: Diagnosing and Changing Organizational Culture: Based on the Competing Values Framework
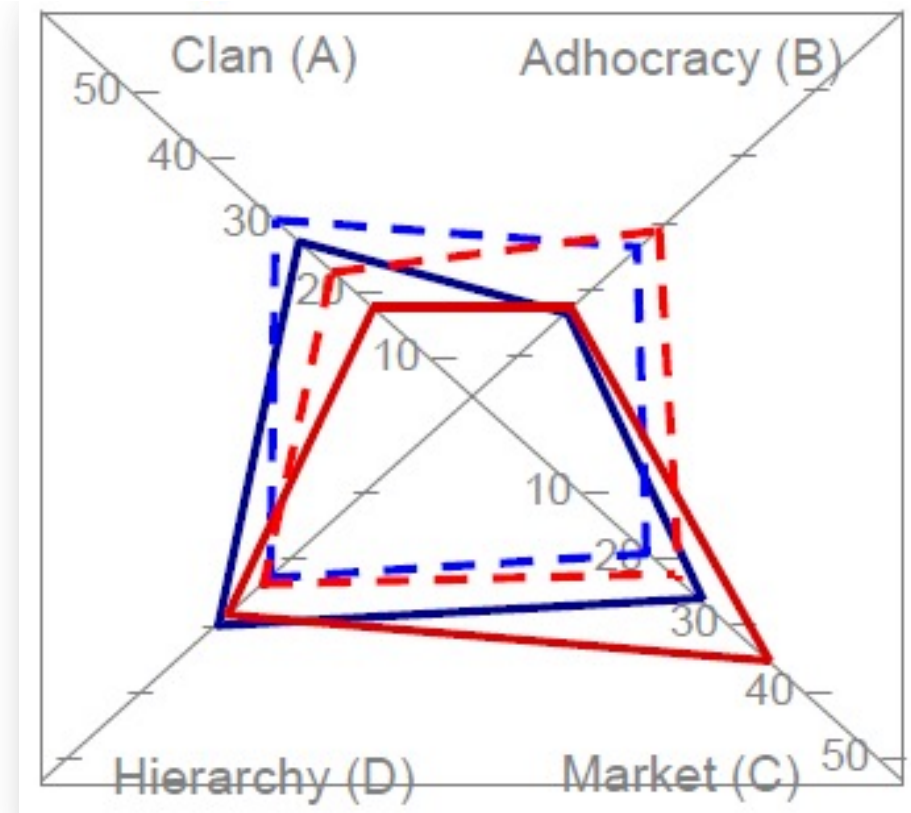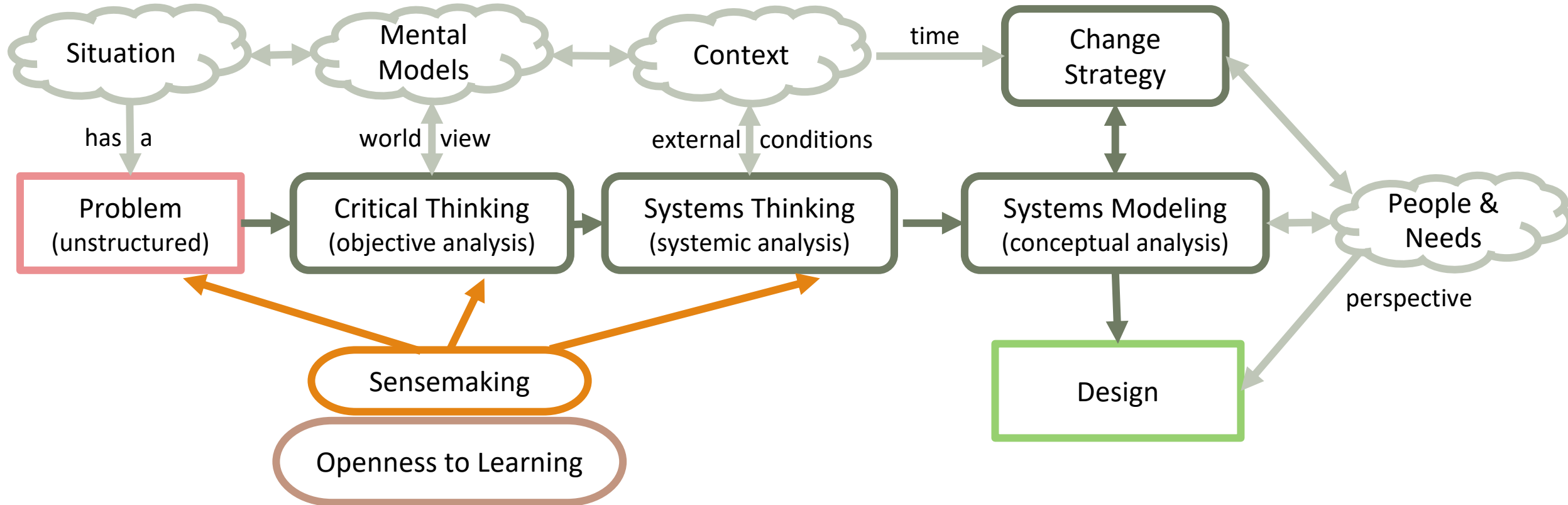
HELIX Organizational Assessment

Qi: Team spread

Within an organization, the two culture assessments show agreement and disagreement on what it is like to work there and their desired future

# Can we Train an Organization: Designing an Educational Experience

Competency Training

5 Competency Sets central to a systems mindset				
Sensemaking	**Cognitive Flexibility**	**A Design Mindset**	**Architectural Competence: Seeing Project Context**	**Leadership: Cycles of Learning**
• Understanding larger context of project • Selecting appropriate practices • Framing the problems and solutions • Dialog and collaboration • Understanding connections between people, processes and events • Exploring and modeling data & information • Visualizing systems & strategies • Facilitating sensemaking activities in project teams	• Multi-disciplinarity • Exploring data and information • Dealing with complexity, uncertainty, variability • Analytics & simulations • Decision making strategies • Causal analysis • Scenario building • Abstraction & visualization • Cognitive load management	• Risk and uncertainty • Iterative development approaches • Human centered methods • Language models, narrative, story-telling • Conceptual modeling • Team design facilitation • Design strategy • Measurement & intervention • Change management	• Modeling the project and its external context together • Architectural patterns • System qualities, ilities, & soft attributes • Understanding and managing stakeholders & commitments • Managing innovation • Market strategy & business case mindset • Setting goals and strategy	• Manage the project and your team together • Personal learning power and self-leadership • Developing learning relationships & collaborating • Fostering collaborative environments • Cultivating informal networks of people • Planning for change • Building strong intra- and inter-personal capabilities

T. McDermott , D. Freeman, "Systems Thinking in the Systems Engineering Process," M. Frank, S. Kordova, H. Shaked (Eds.), Systems Thinking: Foundation, Uses and Challenges, Nova Science Publishers, 2016.

Base Curriculum

1. **Applied Systems Thinking** – introduce the terminology and basic concepts of critical and systems thinking and problem solving, creating an initial mindset in the group, and providing the tools for these skills.
2. **Self-leadership, Purpose, and Learning Power** – introduce the concepts of learning power and build individual, group, and organizational goals for attainment of individual learning capacity across the program.
3. **Solving the Right Problem** – integrate the systems and critical thinking concepts into case studies applied to engineering a system. This explores practical application of sensemaking, architecture, and design tools into the individual's work.
4. **Leading in Teams** - integrate the systems and critical thinking concepts into case studies applied to team leadership. This introduces methods for leading and working in teams centered around purpose, mindful agency, and collaboration.

Applied Systems Thinking	Self-leadership, Purpose, and Learning
Solving the Right Problem	Leading in Teams
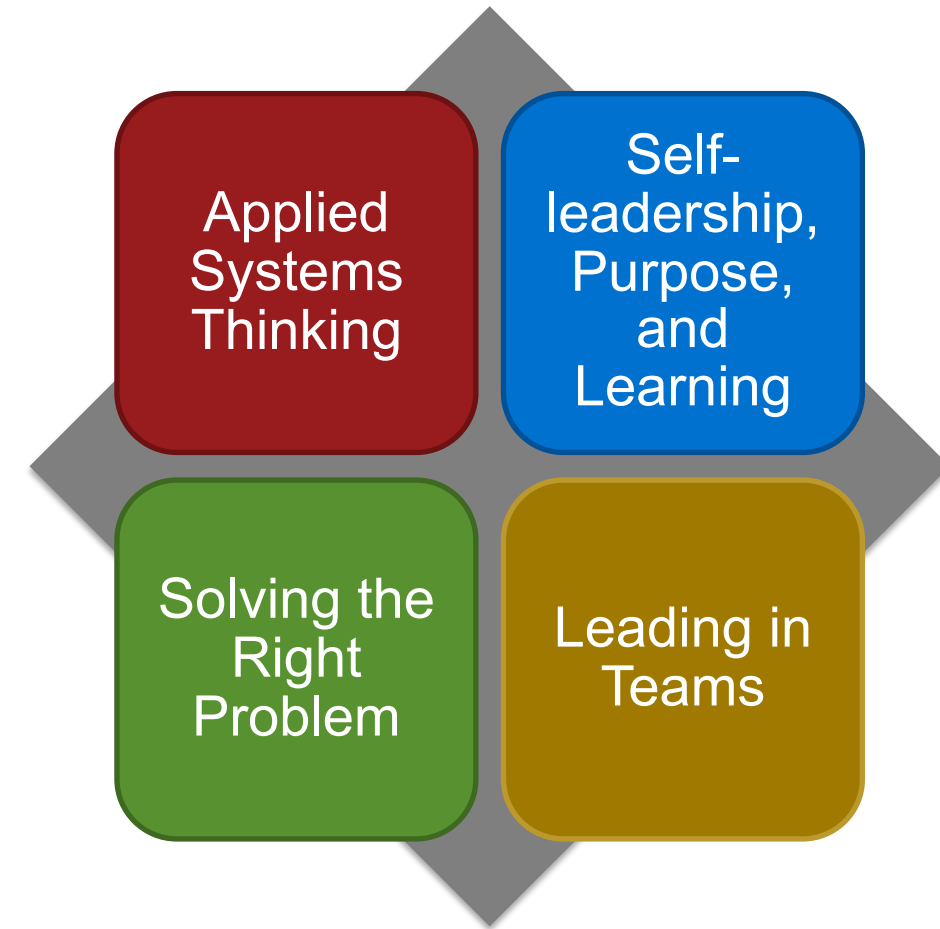
Full Process Framework
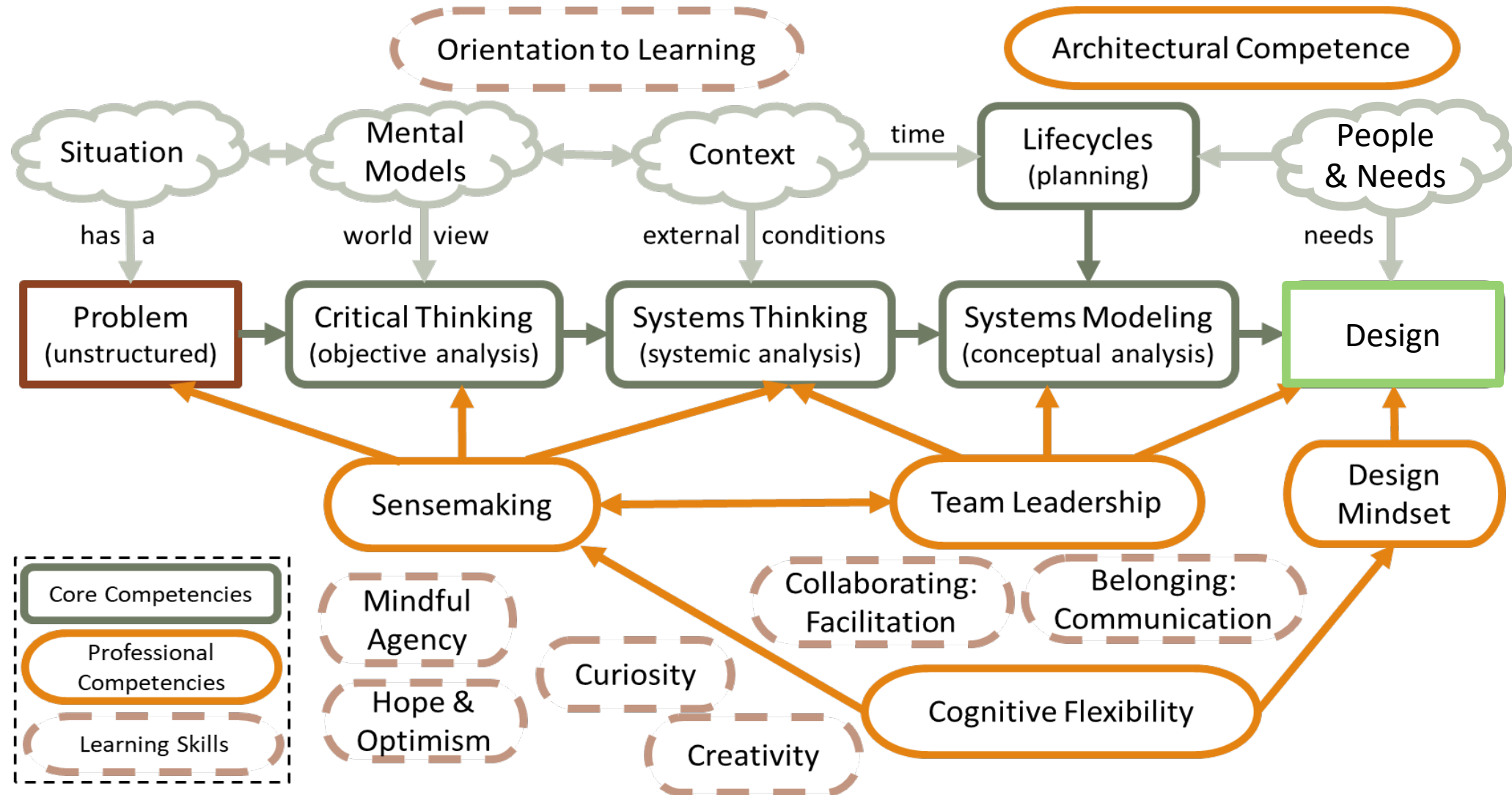
Summary

- Complex problem solving, self-leadership, and working in teams are cited as some of the most desirable work skills in today's rapidly evolving environment.

- This will continue to become more important as more basic skills become automated and intensely human cognitive skills like problem solving are prized.

- Complex problem solving and associated systems and critical thinking proficiencies, along with individual capacity for cognitive flexibility, are professional disciplines that are not developed positionally and must be integrated into general education and work.

- Self-leadership and team-leadership are the foundations and must be continually developed and assessed in authentic learning situations.

- The marriage of HELIX and Jearni creates a frame-work for integrating and developing proficiencies for complex problem solving, based on established research in systems thinking proficiencies and learning power.

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