

A Shift to Systems Thinking

Important Big Ideas		
Topic	Big Idea	Cues for Inquiry and Learning
Unity Within Diversity: Isomorphism	Systems often share parallel principles, structures, or internal relationship patterns with other systems, forming unity and commonality which on casual observation does not appear to exist.	<p>Concept of metaphor</p> <p>People of different races, religions, languages and cultures are more the same than different by virtue of their common humanity.</p> <p>How is doing math like doing music?</p> <p>An ecosystem is like my family because...</p> <p>Musical notes are like points on a graph because...</p> <p>Why or how can the melody of a song be described as “sweet?” How is a sound like a flavor?</p> <p>Compare and contrast Native American families of the 18th century with yours.</p> <p>How is football like baseball? How is it different?</p> <p>Create a classification system for the junk in your junk drawer, or the toys in your toy box, or...</p>
Inputs, Outputs and Equilibrium	Systems function most successfully and sustainably when input and output flows are balanced to create equilibrium.	<p>Have you ever taken a bath? What happens if the water is filling the tub faster than it is draining out? What do you have to do so that the water level remains constant?</p> <p>How can our happiness be sustainable?</p> <p>How can we be sure the cookie jar always has cookies?</p> <p>Why doesn't our well run dry?</p> <p>What goes in, must come out!</p> <p>How does a plane stay up in the air? Why does that mobile stay balanced?</p>
Time and Scale	Conditions, circumstances and problems can only be effectively addressed or evaluated when system dynamics are viewed across a wide range of time and scale.	<p>How will learning math today help me in the future?</p> <p>Will changing the direction of the boat by this tiny amount REALLY take us to a different city by the end of our trip?</p> <p>Just one little germ gave me a cold that ruined my whole week.</p> <p>Moving that domino by a hair caused the Rube Goldberg machine to fail.</p> <p>A butterfly in San Francisco can change the course of a cyclone in Bangladesh.</p>
Nested Systems	Conditions, circumstances and problems can only be effectively addressed or evaluated through considering relationships between sub-systems and the larger systems they are contained in.	<p>Aspen forests are shrinking in Montana because of the absence of wolves.</p> <p>My garden is dying because the principal got sick. (?)</p> <p>Why can't we learn about what we want to learn about?</p> <p>How can the well being of a small country across the world affect my happiness this weekend?</p>
Feedback Loops	Actions and events can have results that strengthen, sustain, and perpetuate the original actions and events.	<p>If we do something, fix something or solve a problem, we can often create other problems which serve to worsen our original problem.</p> <p>The louder it is in the room, the louder I need to talk, and this makes it louder in the room, which in turn makes me need to talk louder...</p> <p>The more you scratch a mosquito bite, the more it will itch, and you will then scratch it even more, making it itch more...</p>

Interdependence	All individual elements of a system are important, depend on each other, and must be recognized and nurtured for the system to flourish.	You're only as strong as your weakest link What depends on what? Who depends on whom? Notice the needs of others—only then will we all get what we need. If we want to win the kickball game, we will have to consider Johnny's feelings... Getting what I want is not sustainable if it comes at the expense of someone else's well being.
Perceptual Shifts		
From parts to whole	Systemic properties are properties of the whole that don't exist for individual parts.	Does our school have a personality? Where does that come from? Why do people form groups and communities? When you hear a note sound alone, it sounds different than when you hear it in another song.
From objects to relationships	"Objects" of study are networks of relationships, embedded in larger networks (nested systems).	Making pictures (concept maps) of family relationships, the school, friends, etc. What depends on what? Who depends on whom? How do we relate to each other?
From objective knowledge to contextual knowledge	Understanding of properties/characteristics only occurs in context of the whole.	Who am I? Who are we? What is community and where do we find it? How am I defined by my community (nation/culture/friends)? Why is math important? Why does it matter if a certain species of salamander goes extinct?
From quantity to quality	Relationships and context are not quantifiably measurable (traditional science), but they do exist.	Accept that sometimes there is no "purely correct" answer, and that is okay! Developing opinions, points of view, observations, ideas, and feelings, are important types of knowledge and learning that we value. Being able to be measured on a traditional test is NOT an indicator of how important a piece of learning is.
From structure to process	Knowledge process—development, renewal, change and transformation—provides meaning and understanding for structures.	Things wear out, and the way they wear out teaches us about them. Keep track of how things change. Studying how a plant (or thing) changes over time can teach us about its structure. I can understand the customs of a distant country only when I understand the process by which it came to be and how it operates.
From contents to pattern	Maps of relationships uncover networks of relationships that appear again and again in various systems.	How are bird families similar or different to human families? How is playing softball like playing music? How are families in India different or similar from families in the United States? Finding similar patterns in different systems (music, math, Islam, Christianity, etc...) help us to create a more compassionate, intelligent and understanding world.

* Adapted from "Speaking Nature's Language: Principles for Sustainability" by Fritof Capra

Practices, study, tools and values that facilitate systems thinking		
Studying behavior over time	Use graphs and graphic images to understand change over time.	Make graphs of your height, weight, class attendance, plant growth, temperature, etc. What do you notice? What might happen in the future? Why?
Mapping causal input/output flows and feedback loops	Make concept maps of relationships.	Map your family relationships. Make a map of your friendship relationships at school. I'll be able to understand the relationships in that story if I can SEE them in a map.
Reflective and contemplative practice	Reflection and the contemplative practice of mindfulness meditation can expand clarity, scope and depth of perception, intuition, compassion, and holistic ways of knowing or "unity consciousness."	We don't see things the way they are, we see things the way we are. –Talmud We get different kinds of knowledge in different ways: How do you know someone loves you? How do you know that $223+429=752$? How do you know you like a song? What do you care about? What do you believe in? What do you stand for? Who are you? Where does "you" and "other" begin or end?
Socratic questioning and critical inquiry	Asking new questions and fostering inquiry-based discussion can profoundly shift people's thinking.	What might be possible if... How would that play out if... What do you see/think when you look at it THIS way? What if... How about... Is that really TRUE? What does its truth depend on?
Intergenerational responsibility	The actions of each generation will profoundly affect the next; consequently it has a moral responsibility to consider long time frames.	Clean up after yourself so others won't have to. Leave things the way you found them. Do unto others, as you would like others to... What do your parents do so you can have a good life?
Biophilia	Humans have a deep genetic attraction to other living things and natural landscapes.	Do you love animals? Why? How does nature make you feel? Spend time outdoors—create an outdoor classroom.